Vivarium

Volume 31
1993

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Introduction

J. E. MURDOCH & J. M. M. H. THIJSSEN

The essays collected in this special issue of *Vivarium* provide a view of contemporary scholarship in the history of late medieval science. The authors, all distinguished scholars in the history of medieval science, have been asked to present the result of their own current research. Although no specific theme was imposed upon the contributors, their articles all explore topics that fall within the area of natural philosophy, rather than mathematics, astronomy, optics, or medicine, to mention only a few of the other branches of medieval science that have recently received attention.

Seen from an historiographic point of view, the authors here collected have been ''working the veins'' that had been opened, on the one hand, by Pierre Duhem (1861-1916), and followed, among others, by Eduard Dijksterhuis (1892-1965), Anneliese Maier (1905-1971), and Marshall Clagett (1916-), and, on the other hand, by Lynn Thorndike (1882-1965), and Dame Frances Yates (1899-1981).[1]

To begin with Duhem, he was firmly convinced that the usual view of science in the Middle Ages separated by a deep abyss from the ''new science'' of the early modern period was totally wrong-headed.[2] In this way he not only helped to establish the historiography of medieval (and Renaissance) science as a legitimate intellectual endeavor, but the work he had done in erasing this ''deep abyss'' set a canon of research topics for subsequent historians of late medieval science.[3]

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[1] This figure of speech is borrowed from D. B. Durant, *Nicole Oresme and the Medieval Origins of Modern Science*, in: Speculum, 16 (1941), 168, who applied it solely to Pierre Duhem.

[2] P. Duhem, *Études sur Leonard de Vinci*, 3 vols., Paris 1906-1913; *Le système du monde. Histoire des doctrines cosmologiques de Platon à Copernic*, 10 vols., Paris 1913-1959.

[3] See J. E. Murdoch, *Pierre Duhem and the History of Late Medieval Science and Philosophy in the Latin West*, in: *Gli studi di filosofia medievale fra otto e novecento*, eds. R. Imbach and A. Maierù, Roma 1991, 253-302 for a critical assessment of Duhem's contribution to and influence on the historiography of late medieval science. See also *Science in the Middle Ages*, ed. D. C. Lindberg, Chicago-London 1978, vii-ix.

One of the earliest to appreciate what Duhem had accomplished was E. J. Dijksterhuis, whose 1924 *Val en worp* continued to focus on subjects that Duhem had rendered canonic, such as projectile motion, the acceleration of bodies in free fall, and the intension and remission of forms.[4]

Over the years, Anneliese Maier and Marshall Clagett had each in their own way enlarged the nucleus of topics on Duhem's research program, although once again the focal point of their work remained substantially Duhemian. Thus, in his 1959 *Science of Mechanics in the Middle Ages*, Clagett divided his subject into medieval statics—a subject Duhem had also treated in his earlier *Les origines de la statique*—medieval kinematics and medieval dynamics, under which rubrics he ever so more fully and adequately investigated the Duhemian topics of the theory of uniform acceleration, the latitude of forms, the continuation of projectile motion, and the free fall of bodies.[5]

Somewhat earlier, in the five volumes of her *Studien zur Naturphilosophie der Spätscholastik*, Anneliese Maier had examined many of the same Duhemian topics, also adding appreciably to his analysis of such subjects as infinity and continuity, the nature of motion, time, and space.[6] Moreover, Maier emphasized the importance of the intellectual context in which late medieval scientific ideas were developed, and in this way came to realize more clearly than Duhem that the accomplishments of late medieval science were of a philosophical nature, that medieval "scientists" were engaged in a reflection on the ontological principles and methods of one's knowledge of nature.[7]

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[4] E. J. Dijksterhuis, *Val en worp. Een bijdrage tot de geschiedenis der mechanica van Aristoteles tot Newton*, Groningen 1924. Often Dijksterhuis gave the original Latin of the primary texts, which Duhem had not; Duhem's consistent habit was to translate them only into French. See also E. J. Dijksterhuis, *De mechanisering van het wereldbeeld*, Amsterdam 1950, translated by C. Dikshoorn as *The Mechanization of the World Picture*, Oxford 1961, which relies upon the work of Duhem, Maier, and Clagett.

[5] M. Clagett, *The Science of Mechanics in the Middle Ages*, Madison WI 1959 (here cited according to the second edition of 1961), and *Nicole Oresme and the Medieval Geometry of Qualities and Motions*, Madison WI 1968. Clagett's position in the historiography of medieval science is outlined in the Introduction to *Mathematics and its Applications to Science and Natural Philosophy in the Middle Ages. Essays in Honor of Marshall Clagett*, eds. E. Grant and J. E. Murdoch, Cambridge 1987, ix-xii.

[6] A. Maier, *Studien zur Naturphilosophie der Spätscholastik*, 5 vols., Roma 1949-1958, hereafter cited according to the titles of the separate volumes, and *Ausgehendes Mittelalter. Gesammelte Aufsätze zur Geistesgeschichte des 14.Jahrhunderts*, 3 vols., Roma 1964-1977. Maier's position in the historiography of late medieval science is evaluated in J. E. Murdoch and E. Sylla, *A. Maier and the History of Medieval Sicence*, in: *Studi sul XIV secolo in memoria di Anneliese Maier*, eds. A. Maierù and A Paravicini Bagliani, Roma 1981, 7-13, Murdoch, *Pierre Duhem*, 283-6, and A. Maierù, *Anneliese Maier e la filosofia della natura tardoscolastico*, in: Imbach and Maierù, *Gli studi*, 303-30.

To turn to the other twentieth-century historiographic trend in treating medieval science, the wealth of material unearthed by Lynn Thorndike caused historians of science to reconsider the role of magic in the scientific enterprise.[8] Thorndike showed that magic formed an important and integral part of medieval thought and experience, and that it was free of the innuendos of backwardness with which his contemporaries associated magic, and above all had important connections with the experimental tradition in medieval science. All the major intellectuals of the Middle Ages, often the same ones who were involved in more "respectable" areas of medieval science, had addressed themselves to problems that belonged to magic, that is, to problems that according to nineteenth- and twentieth-century standards were considered non-scientific and irrational. Thorndike's monumental work put into question the tacit assumption of historians of science that magic and science were two completely separated, even opposed enterprises, that magic was pseudo-science and stood to science as the irrational to the rational. His suggestion that the occultist tradition, i.e. the alchemical, astrological and magical beliefs, remained an integral part of the intellectual resources of the medieval world of learning was taken up, reinforced and transferred into the seventeenth century by Frances Yates.[9] She maintained that "hermeticism" and the rise of modern science shared common ground in that both were manifestations of the same intellectual impulses. The so-called Yates thesis has had a great impact on the historiography of early modern science. It lead to an exploration of the significance of hermetism—understood by Yates and by some seventeenth-century authors as occultism—for the Scientific Revolution.[10]

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[7] See for example Maier, *Ausgehendes Mittelalter*, 2: 457, where she speaks of a "Reflexion über die Grundlagen und die Methoden der Naturerkenntnis."

[8] L. Thorndike, *A History of Magic and Experimental Science*, 8 vols., New York 1923-1953.

[9] F. Yates, *Giordano Bruno and the Hermetic Tradition*, London 1964, where she also referred to the work of Thorndike. Before Yates, the importance of the so-called hermetic tradition had been articulated by E. Garin in *Considerazioni sulla magia*, and *Magia e astrologia nel pensiero del rinascimento*, both republished in his *Medioevo e Rinascimento*, Bari 1954, and by P. Rossi, *Francesco Bacone: Dalla magia alla scienza*, Torino 1957.

[10] For the impact of the Yates thesis on the historiography of early modern science see *Reason, Experiment and Mysticism in the Scientific Revolution*, eds. M. L. Righini

The articles in this volume can all be considered as explorations and extensions of research topics inaugurated by Duhem-Dijksterhuis-Maier-Clagett or Thorndike-Yates, respectively. Stefano Caroti discusses Nicholas Oresme's theory of motion within the context of John Buridan's and Albert of Saxony's views. Both the topic of the nature of motion and the intellectual framework of the "Parisian school" were already on Duhem's and Maier's canonic roster.[11] New in Caroti's approach, however, is that he is the first to systematically focus on Oresme's *Commentary on the Physics.* The rediscovery of the unique copy of this text, preserved in the manuscript Sevilla, Bibl. Colombina 7-6-30, was announced in 1962 by Guy Beaujouan.[12] Although Maier mentions Oresme's *Physics* in her later publications, she never really included it in her discussions.[13] Caroti's analysis and partial edition of the cluster of *quaestiones* devoted to motion fill an important gap in scholarship, not only with respect to Oresme's own views, but also with regard to the complex relations between Oresme and the other thinkers who were once singled out by Duhem and Maier as the leaders of the Parisian school, namely John Buridan, Albert of Saxony, and Marsilius of Inghen.

Edith Sylla also takes up a theme that was previously discussed by Duhem, Dijksterhuis, Maier, and Clagett, namely the problem of the natural motion of inanimate bodies (i.e., free fall and gravitation).[14] Her point of view, however, is completely different from that of these two scholars. Besides presenting the views of John Buridan, Albert of

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Bonelli and W. R. Shea, London 1975, and more recently B. Vickers, *Introduction*, in: *Occult and Scientific Mentalities in the Renaissance*, ed. B. Vickers, Cambridge 1984, 1-55, and B. P. Copenhaver, *Natural magic, hermetism and occultism in early modern science*, in: *Reappraisals of the Scientific Revolution*, eds. D. C. Lindberg and R. S. Westman, Cambridge 1990, 261-303. Copenhaver, *Natural magic*, 280-90 is fundamental for the terminology. We have used the term "occultism" in Copenhaver's sense. The term "hermetism" should, according to Copenhaver, be used to indicate an affiliation with the hermetic corpus of texts. Kepler, in a much quoted passage in the *Harmonies of the Cosmos* used it as a term of derision, to discredit the work of Robert Fludd.

[11] See, for example, Duhem, *Études*, 3: 388-99, A. Maier, *Zwischen Philosophie und Mechanik*, Roma 1958, 134-8, and Dijksterhuis, *Mechanization*, 185.

[12] G. Beaujouan, *Manuscrits scientifiques médiévaux de la Bibliothèque Colombine de Seville*, in: *Proceedings of the Xth International Congress on the History of Science, Ithaca 1962*, Paris 1964, 633.

[13] A. Maier, *Zwei Grundprobleme der scholastischen Naturphilosophie*, Roma 1968, 358, 382-285, and 389.

[14] Duhem, *Études*, 3: 23-34, 309-314, *Le système*, 8: 169-227, Dijksterhuis, *Val en worp*, 60-88, *Mechanization*, 109-15, Clagett, *Science*, 541-83, and especially A. Maier, *An der Grenze von Scholastik und Naturwissenschaft*, Roma 1952, 143-83.

Saxony and (John) Marsilius of Inghen,[15] her paper also serves the purpose of providing important new material for the study of continuity and transformation within the Aristotelian tradition of natural philosophy.[16] Her examination of the mutual influence of the different commentaries on the *Physics* by John Buridan, Albert of Saxony, and (John) Marsilius of Inghen, gives an interesting view on the *modus operandi* of these authors. Probably, the Parisians took each other's commentaries, often available in several different redactions, as the point of departure for their own solutions. At times it is impossible to establish who has been copying whom. In addition, Sylla studies the esteem these fourteenth-century authors held in the eyes of Nicoletto Vernia and Girolamo Pico, thus giving a Renaissance perspective on the medieval Aristotelian tradition. The close intertwining of the different commentaries on the *Physics* so meticuously documented by Sylla, corroborates earlier observations by Stefano Caroti concerning the commentaries on the *De generatione et corruptione* produced by the Parisian school.[17] Perhaps we have here come across one of the factors that may explain the element of unity within Aristotelianism.

Edward Grant's paper centers on two of Duhem's "champions"—Oresme and Buridan—but the issue he discusses is entirely Maierian: the methodology of science.[18] Grant compares Buridan's and Oresme's approaches to scientific knowledge, his analysis focusing on the possibility of acquiring certain knowledge of nature through experience. During the Middle Ages, the discussion of the possibility of "natural knowledge" was associated with views on causality and induction and with Aristotle's remarks on the requirements of scientific knowledge in the *Posterior Analytics* II, 19. Buridan was heralded by Maier as the defender of experience and induction against the attacks of Nicholas of Autrecourt.[19] This picture seems to be corroborated in Grant's study. One of the results of his comparison is that Buridan had greater faith in the reliability of natural knowledge than Oresme, who time and again emphasizes that knowledge of the natural world, acquired through sense experience and induction, is unreliable and uncertain.

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[15] The identity of John Marsilius Inghen is unknown, but he should, in any case, not be confounded with Marsilius of Inghen. See also Edith Sylla's article in this volume, notes 16 and 17.

[16] See J. M. M. H. Thijssen, *Some Reflections on Continuity and Transformation of Aristotelianism in Medieval (and Renaissance) Natural Philosophy*, in: Documenti e studi sulla tradizione filosofica medievale, 2 (1991), 503-28 for a recent attempt to interpret the unity and flexibility of the Aristotelian tradition in natural philosophy.

[17] See in particular S. Caroti, *Da Buridano a Marsilio di Inghen: la tradizione parigina della discussione de reactione*, in: Medioevo, 15 (1989), 172-233, and also his paper in this volume.

[18] See A. Maier, *Metaphysische Hintergründe der spätscholastischen Naturphilosophie*, Roma 1955, 384-97, and *Ausgehendes Mittelalter*, 2: 367-428.

The last essay which addresses a topic that was inherited from Duhem and Maier is by André Goddu. He gives an original interpretation of the application of mathematics in medieval science. Since the studies of Duhem, Maier, Clagett, and Dijksterhuis investigation of medieval attempts to measure all kinds of phenomena, such as change, and powers or capacities, has become standard in comprehensive treatments of late medieval science. The problem has always been how medieval efforts of mathematicizing or measuring in natural philosophy should be evaluated. Recent historiography has suggested that the application of mathematics was a mode of argumentation, a specific "linguistic" technique, not unlike the semantic techniques that were applied in natural philosophy.[20] Goddu carries this suggestion a bit further. Through an ingenious analysis of Ockham's theory of connotation, he illustrates that late medieval philosophers indeed thought of mathematics as a language, as a "symbolic formalism capable of many interpretations." The application of mathematics to certain physical problems was unrelated to any specific commitments concerning the status of mathematical objects; mathematical analysis was not determined by ontological considerations. Goddu's suggestions may become the startingpoint for a reassessment of the traditionally perceived separation between the analytic Parisian school and the mathematical Oxford school in late medieval science.[21]

The essays by George Molland and William Newman pursue the broader implications of the work of Thorndike and Yates on the role of occultism in science. Molland's paper examines two specific aspects of the hermetic tradition, namely, its doxographic role and its theoretical role, i.e., its conceptual significance in providing new theories and explanations.[22] Renaissance thinkers have usually been singled out as particularly inclined to emphasize the value of an idea from their own age, as proponents of the notion of *prisca sapientia.* The most important name in these intellectual genealogies, in which ideas were referred to a sanctifying past, was Hermes Trismegistus.[23] However, as Molland's paper demonstrates, already Roger Bacon attributed an important role to things ancient, to *prisca auctoritas* in his quest for truth. Moreover, somewhat ironically, he himself became a *prisca auctoritas* for many alchemical *spuria.* In the second part of his paper, Molland investigates the theoretical aspect of occultism, in particular of natural magic, in Bacon's work.

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[19] But see J. M. M. H. Thijssen, *John Buridan and Nicholas of Autrecourt on Causality and Induction*, in: Traditio, 43 (1987), 237-55 for criticism of this interpretation.
[20] See Murdoch, *Pierre Duhem*, 293-99.
[21] Cf. A. Maier, *Die Vorläufer Galileis im 14.Jahrhundert*, Roma 1949, 3-4.
[22] See Copenhaver, *Natural magic*, 265.

Newman's article is concerned with the Paracelsian Johannes Baptista van Helmont (1579-1644). He has been praised as an exponent of the Scientific Revolution, and condemned as a Hermetic and occultist. The results of Newman's study, however, show that Van Helmont's position in the rise of modern science is far more complex. First, as has also been pointed out by Allen Debus, the new approach to the study of nature inaugurated by the Paracelsians was, as a matter of fact, a genuine alternative and even rival to the world view of the mechanical philosophers, so readily conceded as dominant in the Scientific Revolution.[24] However, as was not appreciated by Debus and others, Van Helmont appropriated a medieval corpuscular theory associated with the name of Geber (Jabir) in his system of thought, and combined this with a Paracelsian tradition. Both the fact that Van Helmont took recourse to medieval sources, and that he adopted corpuscularism—a system usually associated with mechanism—may come as a surprise even to those historians of early modern science who are convinced that Paracelsian-alchemical literature must be integrated in the historiographical accounts of the Scientific Revolution.

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[23] Copenhaver, *Natural magic,* 266-70.

[24] See A. G. Debus, *The Chemical Debates of the Seventeenth Century: the Reaction to Robert Fludd and Jean Baptiste van Helmont,* in: *Reason,* eds. Rigini Bonelli and Shea, 19-49; *The Chemical Philosophy: Paracelsian Science and Medicine in the Sixteenth and Seventeenth Centuries,* 2 vols., New York 1977, and also the articles collected in *Chemistry, Alchemy and the New Philosophy, 1550-1700,* London 1987.

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*Oresme on Motion (Questiones super Physicam, III, 2-7)**

STEFANO CAROTI

1. Preliminary remarks

In their chapter on motion published in *Science in the Middle Ages*, John E. Murdoch and Edith D. Sylla mitigate some of A. Maier's statements on the disagreements between Ockham and Buridan concerning motion.[1] Maier was actually inclined categorically to contrast[2] Ockham's and Buridan's views of motion; in fact, she does not mention their common effort in contending against a general theory of motion that relied upon the necessity of postulating a *res superaddita* in addition to the things suffering alteration and augmentation/diminution (*alteratio, augmentatio, diminutio*). On the contrary, she emphasizes the difference between Ockham and Buridan on the subject of local motion, which for the latter is not to be identified either with the *mobile* or with the space, but with a *fluxus*, which he considers a *conditio* or an accidental form inhering in the *mobile*.[3] Buridan puts forward his pro-

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* I wish to thank Alfonso Maierù for his suggestions and Pietro Corsi for his help with the translation of this paper.

[1] J. E. Murdoch, E. D. Sylla, *The Science of Motion*, in: D. C. Lindberg (ed.), *Science in the Middle Ages*, Chicago and London 1978, 217 (The Chicago History of Science and Medicine)

[2] A. Maier, *Zwischen Philosophie und Mechanik. Studien zur Naturphilosophie der Spätscholastik*, Roma 1958, 53, 117 (Storia e letteratura. Raccolta di studi e testi, 69). The opposition between Ockham and Buridan lies in the different role assigned by Maier to them in the development of scientific thought: the former is in fact viewed as the supporter of a position more distant from the modern than those of his predecessors (see pp. 41-2, 100 and for a more correct appraisal J. E. Murdoch, E. D. Sylla, *The Science of Motion*, 216-7), the latter prepares the way, according to Maier, to the modern law of inertia (A. Maier, *Zwischen*, 132-3, 151). On A. Maier see A. Maierù, *Anneliese Maier e la filosofia della natura tardoscolastica*, in: R. Imbach, A. Maierù (eds.), *Gli studi di filosofia medievale tra Otto e Novecento. Contributo a un bilancio storiografico.* Atti del convegno internazionale. Roma, 21-23 settembre 1989, Roma 1991, 303-30 (Storia e letteratura. Raccolta di studi e testi, 179).

[3] "Nos autem dicimus primo quod omnis motus est subiective in mobili, scilicet in eo quod movetur, per realem inherentiam sicut albedo esset in pariete", Johannes

posal of considering local motion a *conditio* or a *fluxus* inhering in the *mobile* (being an adherent in this way to what I shall call a *res*-theory) after introducing the casus of the rectilinear motion of the universe. Some years later, Albert of Saxony in his commentary on the *Physics* dealt with local motion where he neatly distinguished between a philosophical and a theological approach: in the former there is no need to have recourse to something in addition to the *mobile*, in the latter motion is identified with a *fluxus* inhering to the *mobile.*[4]

Oresme's discussion of motion in the first seven questions of his commentary on the *Physics* — which Maier thought was lost when she wrote *Zwischen Philosophie und Mechanik* — presents some original and interesting elements in comparison either with Buridan or Albert of Saxony. Oresme's philosophical attitude — which I shall sometimes call ''nominalist'' without charging the word with any specific meaning and only in order to stress its opposition to a *res*-theory[5] — is at one with both Buridan or Albert as far as their efforts to reject a *res superaddita* in their explanations of alteration and augmentation/diminution; he is nevertheless decidedly more determined than both Buridan and Albert to refute a *res*-theory for local motion.

The first seven *Questiones* of Book III of Oresme's commentary on the *Physics* are very important in order to sketch a more complete picture of the medieval dispute about different views with respect to motion. I will limit myself to mention the following, concerning exclusively local motion: 1) the *fluxus* turns out to assume, if interpreted in a Buridanian way (which Oresme does not consider correct), a definitely ''realistic'' feature;[6] 2) Oresme's new rendering of *fluxus*

Buridanus, *Questiones super octo libros Physicorum*, Paris 1509, III, 12, f. 54vb (repr. Frankfurt a. M. 1964); see A. Maier, *Zwischen*, 129.

[4] Even in the titles of his *quaestiones* Albert of Saxony distinguishes these two different spheres: ''utrum secundum Aristotelem et eius Commentatorem ad hoc quod aliquid moveatur localiter requiratur aliqua res que sit quidam fluxus distinctus a mobili et loco'' and ''utrum admittentes casus divinos oporteat concedere quod motus localis sit alia res a mobili et loco'', Albertus de Saxonia, *Questiones super octo libros Physicorum*, Venetiis 1504, III, 6 and 7, ff. 36rb-37va.

[5] In particular, I use the term ''nominalist'' to refer to Ockham's attitude in refusing a *res*-theory for motion, that is, a *res superaddita* different from the *mobile* and inhering in it. On Ockham's discussion of motion see H. Shapiro, *Motion, Time and Place According to William Ockham*, St. Bonaventure N.Y.- Louvain-Paderborn 1957, 1-191 (Franciscan Institute Publication, Philosophy Series 16); M. McCord Adams, *William Ockham*, 2 vols., Notre Dame 1987, II, 799-827 (Publications in Medieval Studies. The Medieval Institute University of Notre Dame, 26).

[6] I use this term, like ''nominalist'' (see the previous footnote) without a specific philosophical import in order to describe an attitude favouring a *res*-theory. On the

allows an explanation of '*motus*' which does not require an inherent *res superaddita* (as Buridan does); Oresme is thus entitled to preserve a substantially "nominalistic" attitude as did Ockham; 3) this special solution is based on the equivalence between *fluxus* and *conditio seu modus ipsius mobilis*, which for Oresme is a *res pure successiva* formed by the different states of a moving thing and, in addition, allows him to maintain the clear-cut distinction between *mobile/res permanens* and *motus/res successiva*.

There are, however, further reasons to stress the importance of Oresme's commentary on the *Physics* within the context of the medieval dispute on motion, some of them urging us to reconsider some of Maier's conclusions on this issue. First and foremost, the relationship between Buridan and Oresme,[7] described by Maier as a complete dependence of the latter on the former, needs to be reassessed in view of the fact that Oresme, even though agreeing with Buridan in viewing motion as a *fluxus*, neatly departs from him in considering this *fluxus* a *modus* of the *mobile* and not an accidental form inhering in it. Moreover, Buridan is not the first and most convinced supporter of a definition of '*motus*' in terms of "*aliter se habere quam prius*" as Maier claimed; Oresme explicitly quotes Witelo's *Perspectiva* as the source of this definition.[8] Moreover, Oresme's influence on the

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medieval debate on *forma fluens/fluxus forme* see Maier, *Zwischen*, 61-143 and D.C. Lindberg, *The Beginnings of Western Science. The European Scientific Tradition in Philosophical, Religious, and Institutional Context, 600 B.C. to A.D. 1450*, Chicago and London, 1992, 292-3.

[7] For a general overview on this topic see E. Grant, *Scientific Thought in Fourteenth-Century Paris: Jean Buridan and Nicole Oresme*, in: M. Pelner Cosman and B. Chandler (eds.), *Machaut's World: Science and Art in the Fourteenth Century*, New York 1978, 105-25 (Annals of the New York Academy of Sciences, 314); as far as the discussion on local motion in these *quaestiones* is concerned Oresme seems less committed than Buridan to theological arguments.

[8] I have already studied this aspect of Oresme's discussion in *La perception du mouvement selon Nicole Oresme (Questiones super Physicam, III, 1)*, forthcoming. See A. Maier, *Zwischen*, 126-7 for Buridan. The source explicitly quoted by Oresme is Witelo, *Perspectiva*, IV, *prop.* 110 (see *Opticae thesaurus Alhazeni Arabis libri septem... Item Witellonis Thuringopoloni libri decem*, Basel 1572, f. 167). The definition of motion as "*aliter se habere quam prius*" is mentioned also by Ockham, who thinks that it is quite identical with his own: "est autem ista descriptio [i.e. that proposed by Ockham] eadem realiter cum illa qua dicitur quod 'mutari est aliter se habere nunc quam prius': non enim aliter aliquid se habet nunc quam prius nisi quia habet formam vel locum quem prius non habuit vel caret forma vel loco quem prius habuit", Guillelmi de Ockham, *Brevis summa libri Physicorum. Summula philosophiae naturalis et Quaestiones in libros Physicorum Aristotelis*, ed. S. Brown, St. Bonaventure 1984, 254, 41-5 (Opera philosophica, 6).

younger colleagues at the University of Paris, which is not acknowledged by Maier, is attested by a quotation in Marsilius of Inghen's commentary on the *Physics.*[9]

In comparison with the commentaries by the most representative authors of the University of Paris (from John Buridan to Marsilius of Inghen), Oresme's[10] commentary presents a more systematic and complete discussion on motion: he scrutinizes and discusses five different opinions, proposes his own solution and tests its capability in explaining motion by confronting it with two definitions of motion which were among the most widespread and quoted in the medieval dispute on the topic (one from Aristotle and the other from Averroes).[11]

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[9] A. Maier, *Zwischen*, 139-40; Maier uses only the *Abbreviationes* attributed to Marsilius, but she also mentions the *Questiones super Physicam*, published by L. Wadding among Scotus' works. See n. 37 of the present article for Marsilius' quotation.

[10] The discovery of Oresme's *Questiones super Physicam* was announced by Guy Beaujouan, who had found them in the ms. 7-6-30 (from which quotations are made) of the Biblioteca Colombina in Sevilla, in 1962 at the 10th International Congress of the History of Science, G. Beaujouan, *Manuscrits scientifiques médiévaux de la Bibliothèque Colombine de Seville*, in: *Acts du dixième Congrès International d'Histoire de Science (Ithaca 26 VIII - 2 IX 1962)*, Paris 1964, 633. M. Markowski (*Le "Questiones super 1-8 libros Physicorum Aristotelis" de Nicole Oresme retrouvées?*, in: Mediaevalia Philosophica Polonorum, 26 (1982), 19-24) ascribes to Oresme a commentary formerly attributed to Buridan, without considering however the manuscript of Sevilla; see the critical remarks of J. M. M. H. Thijssen, *The Short Redaction of John Buridan's Questions on the Physics and their Relation to the Questions on the Physics attributed to Marsilius of Inghen*, in: Archives d'Histoire Littéraire et Doctrinale du Moyen Age, 52 (1986), 238-9.

[11] I do not intend to deal with the chronology of this commentary (for which see M. Clagett, *Nicole Oresme and the Medieval Geometry of Qualities and Motions. A Treatise on the Uniformity and Difformity Known as "Tractatus de configurationibus qualitatum et motuum"*, Madison, Milwaukee, and London 1968, 646 (The University of Wisconsin Publications in Medieval Science, 11)); I only wish to point out how the theory of *reactio* in Book III, *q.* 8 is different from that of his *Questiones super de generatione* (see S. Caroti, *Da Buridano a Marsilio di Inghen: la tradizione parigina della discussione de reactione*, in: Medioevo, 15 (1989), 211): "Quarta conclusio est quod numquam movetur [scil. agens] a passo mediante virtute qua passum resistit et movetur. Probatur, quia quod movet est fortius ergo, si motus illius moveretur, debilius moveret fortius, quod est contra Aristotelem septimo huius. Sed contra hoc est Aristoteles in primo De generatione, quia omne agens naturale in agendo repatitur; secundo, patet experientia quod ferrum calidum calefacit aquam et frigescit ab ipsa. Ad primum dico quod causa quare agens repatitur a passo est quia in utroque sunt plures qualitates, ideo una est fortior in agente secundum quam agit in debiliorem in patiente, et e converso una est fortior in passo secundum quam fit reactio. Modo ille qualitates dicuntur agentia immediata, ideo sunt plures actiones et plura agentia. Ad secundum per idem dico quod caliditas ferri remittit frigiditatem aque et non e converso, sed humiditas aque remittit siccitatem ferri que est debilior, ex quo consequitur frigefactio vel remissio caliditatis. Et ex hoc sequitur: primo, quod si in ferro non esset nisi caliditas et in aqua frigiditas non fieret reactio", f. 35rb-va (the very few corrections to Oresme's

In this paper I shall deal with the five opinions presented and discussed by Oresme, together with his own solution; I shall omit a comparison between the position Oresme has taken in this commentary and the one defended in his other writings quoted by Maier.[12]

The five opinions considered *rationales* by Oresme are summarized in Book III, *q.* 2.[13] They pertain to the kind of being denoted by '*motus*' rather than its existence, which the natural philosopher must presuppose:

> omnis opinio rationalis potest reduci ad aliquam istarum: prima est quod motus non est aliquid vel aliqua, ideo dicunt quod nihil est. Secunda opinio est quod motus non est aliquid sed bene est aliqua, scilicet ita sic se habere ad motorem et mobile et acquisitum, ac si esset nomen correlativum. Tertia est quod motus est *mobile*. Quarta est quod motus est acquisitum per motum. Quinta est quod est quidam *fluxus* seu accidens distinctum a quolibet permanenti.[14]

Oresme deals with the first two opinions in Book III, *q.* 2, with the third in *q.* 3,[15] with the fourth in *q.* 4 and 5,[16] and with the fifth in *q.* 6;[17] he puts forward his own solution in *q.* 7,[18] testing it in the following *quaestio*[19] through a comparison with the two definitions by Aristotle and Averroes we mentioned above.

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text in the quotations have not been noted; I am going to publish in the near future the critical edition of the eight questions on the III Book of the *Physics*). The conditions required for *reactio* here proposed are censured in the *Questiones super de generatione* and are identical to that of Richard Swineshead's *Calculationes*. It is in any case very difficult to assume only in this instance an influence of Swineshead when Oresme writes his commentary on the *Physics*, followed by a change when he comments the *De generatione*. The practice of medieval *magistri* of revising their commentaries prevents, moreover, one to state with sufficient certitude the chronological relations between their writings; see J. Hamesse, *"Reportatio" et transmission des textes*, in: M. Asztalos (ed.), *The Editing of Theological and Philosophical Texts from the Middle Ages*. Acts of the Conference arranged by the Department of Classical Languages, University of Stockholm, 29-31 August 1984, Stockholm 1986, 7-34 (Acta Universitatis Stockholmiensis, Studia Latina Stockholmiensia, 30).

[12] A. Maier, *Zwischen*, 133-8.

[13] "Utrum motus sit aliquid", ff. 31ra-31vb.

[14] F. 31rb.

[15] "Utrum motus sit res mota vel ipsum mobile", ff. 31vb-32va.

[16] "Utrum motus sit res acquisita mobili dum movetur" and "utrum motus localis sit illud quod acquiritur mobili tali motu, scilicet locus in quo et circa quod mobile movetur", III, 4, ff. 32va-33ra; III, 5, ff. 33ra-33vb.

[17] "Utrum motus sit res successiva sive fluxus distinctus a rebus permanentibus cuiusmodi sunt mobile et res acquisita ad quam est motus", ff. 33vb-34rb.

[18] "Utrum moveri sit aliter se habere continue quam prius", ff. 34rb-35ra.

[19] "Utrum motus bene diffiniatur quando dicitur quod est actus entis in potentia secundum quod in potentia", ff. 35ra-35va.

2. *Opinio I: "motus est nihil"*

The supporters of this opinion could be traced back to the Greek philosophers criticized by Aristotle in Book III of the *Physics*;[20] however, some typical arguments found in the sophismatic contexts concerning problems raised either by verbs of motion or more generally of change[21] or by the relations between *pars* and *totum*, do, nevertheless, mark an invitation to the examination of more recent debates.

This opinion is grounded on a special ontology according to which only *incomplexe significabilia*[22] are entitled to denote existent beings; on the other hand, the denotation of '*motus*', a *complexe significabile* having the same meaning of "*mobile moveri*", has no place either in the category of substance or in any other.[23]

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[20] See e. g. S. Thomas Aquinas, *In octo libros Physicorum Aristotelis expositio*, ed. P. M. Maggiolo, Torino-Roma 1965, III, l. 3, 294, 149 and Walter Burley, *In Physicam Aristotelis Expositio et questiones*, Venetiis 1501, f. 66ra (repr., Hildesheim - New York 1972). Buridan discusses a very similar problem in his commentary on the *Physics*, III, 6: "utrum motus localis est vel utrum hec est vera: "motus localis est" ", v. Johannes Buridanus, *Questiones*, f. 48va. In Jean of Mirecourt's commentary to the *Sentences* an opinion is mentioned according to which "*actio nihil est nec motus, sed modi se habendi rerum*", which bears witness to the circulation of this position in the university milieu, see A. Maier, *Zwischen*, 333; see also F. Stegmüller, *Die zwei Apologien des Jean de Mirecourt*, in: Recherches de théologie ancienne et médiévale, 5 (1933), 67-8 no. 45. Oresme does not agree with the opinion according to which "*motus est nihil*", but he too consents, as we shall see, to the identification of '*motus*' with the *modus se habendi (mobilis)*.

[21] For example, Buridan's Sophismata "*Omne quod movetur movebatur prius*" and "*Nulla mutatio est instantanea*", v. Johannes Buridanus, *Sophismata*, ed. T. K. Scott, Stuttgart-Bad Cannstatt 1977, 120-2 (Grammatica speculativa 1).

[22] "Pro prima opinione est sciendum quod quedam sunt significabilia incomplexe sicut materia, compositum, forma substantialis aut accidentalis; et alia complexe sicut "hominem esse animal", "hominem currere" et sic de aliis. Secundo, notandum quod 'motus' non est significabile incomplexe proprie, quia 'motus' non est aliud quam "mobile moveri" et nihil est et ideo motus nihil est", f. 31rb. On *complexe significabile* see G. Nuchelmans, *Theories of the Proposition. Ancient and medieval conceptions of the bearers of truth and falsity*, Amsterdam-London 1973, 227-42 (North-Holland Linguistic Series, 8). In the first of the *notabilia* of Book III, *q.* 1 Oresme emphasizes the relationship between *cognitio intuitiva, nomina absoluta* and *incomplexe significabilia*: "notandum quod aliquid potest cognosci dupliciter: uno modo intuitive et incomplexe, alio modo complexe, et secundum hoc quedam nomina significant absolute et quedam comparative vel connotative, et aliquid dicitur cognosci quando multa complexa cognoscuntur quibus enuntiatur aliquid de alio", f. 30ra. I did not have K. Tachau's article on Oresme's theory of *complexe significabile* at my disposal; see P. J. Vàsquez Janiero, *Duns Scoto e altri maestri francescani all'8o Congresso internazionale di filosofia medievale (Helsinki, 1987)*, in: Antonianum, 63 (1988), 157, 159.

[23] It is the first *pro*-argument: "Probatur primo, quia "mobile moveri" non est substantia nec accidens, quia talis est significabile incomplexe; modo omne ens est substantia aut accidens", f. 31rb. In the last argument for the expression "mobile

Oresme appeals to Aristotle's authority (arg. 1), the *communis opinio* (arg. 2) and either the possibility for motion to be perceived (arg. 5) or, once its existence is denied, the impossibility to have adequate criteria for discriminating motion from rest (arg. 6). In the arguments against this first opinion Oresme points to some logical and semantic problems concerning propositions containing verbs of motion. In particular, in the third argument the existence of motion is granted on the basis of the term '*movere*' being a genus of special kinds of motion exemplified by *currere* or *alterare*;[24] in the fourth argument, the possibility of *complexe significabilia* to be predicated of other *complexe significabilia* is acknowledged;[25] in the seventh argument, sentences like "*aliquid movetur*" are considered meaningful because it is possible to locate in the world events such as those they describe.[26]

3. *Opinio II: "motus est aliqua, scil. mobile et illa ad que se habet aliter quam prius"*

This opinion, although dealt with more cursorily, deserves particular attention because Oresme will make use of it for his own solution proposed in Book III, *q.* 7.

In the conclusion (where this opinion is recorded in its complete

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moveri" only a *suppositio materialis* is allowed, without a denotation in the world: "Quarto, illa: 'mobile moveri est aliquid', aut ergo subiectum supponit materialiter sicut pro illa propositione 'mobile movetur', et tunc bene est aliquid, sed non est ad propositum, quia est vera propositio vel oratio; aut supponit significative, et tunc oratio est incongrua et non intelligibilis, ut patet per grammaticam", f. 31rb. In the replies to these arguments the denotation of '*motus*' is fixed in the *forma fluens* or in the *mobile*: "Tunc ad rationes prime opinionis. Ad primam, potest dici quod 'mobile moveri' est accidens, quia aliqui dicunt quod est forma... et si non sit accidens tunc erit mobile vel aliquid tale, et sic erit substantia... Ad ultimam, quomodo supponit 'mobile moveri' potest dici quod supponit significative et est congrua, quia supponit pro aliqua re et tenetur neutraliter loco unius dictionis", f. 31va.

[24] "Tertio omne genus predicatur de sua specie affirmative, sed movere est genus ad currere et alterare et ita de aliis. Et ideo Aristoteles dicit illas species motus, ergo hec est vera: "aliquid currere est aliquod moveri". Et cum de quolibet predicamento dicatur 'esse' vel 'ens' vel 'aliquid', sequitur quod moveri est aliquid", f. 31rb.

[25] "Quarto, supposita divisione illius opinionis, sicut significabilia incomplexe predicantur de se invicem, dicendo "hoc est substantia", ita etiam erit de significabilibus complexe dicendo quod currere est moveri et esse album est esse coloratum", f. 31rb.

[26] "Iterum, saltem secundum omnes hec est concedenda: "aliquid movetur" vel "celum movetur", ergo ita est sicut ipsa significat, quia ab eo quod res est vel non est etc. Sed si est quod aliquid movetur, tunc falsum est dicere quod aliquid moveri nihil est", f. 31rb-va.

form[27]), it is pointed out that in order to fix the denotation of '*motus*', more things (*aliqua*) are required, that is the *mobile* and those things relative to which it assumes different positions (*illa ad que se habet aliter quam prius*). Even though Oresme does not state explicitly the distinction he makes later on (in Book III, *q.* 7) between internal (*intrinseca*) and external (*extrinseca*) reference marks, these things are external to the *mobile*, as clearly emerges from the two *pro-* and the second *con-* arguments.[28]

We shall see how, in his discussion of motion, Oresme is constantly preoccupied with avoiding the obstacle of postulating a special being in addition to the *mobile* or to the *res acquisita* or *deperdita* according to the different kinds of motions. In this *quaestio*, he emphasizes how the relationship between different things that is called forth by the expression "*aliter se habere quam prius*" is not a special being in addition to its components.

In the critical remarks against this opinion, Oresme quotes a theory of relations which prevents the fixing of the denotation of relative terms in more than a single thing,[29] and which relies on the synonymity between concrete and abstract terms and on a word's power not only of denoting but also of connoting. These are very important remarks for at least two reasons: a) the introduction of connotative terms;[30] b) the mention of relations could be a hint to the identification of a possible source of Oresme's *modus seu conditio rei*, a very important element for his solution.[31]

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[27] "Motus non est aliquid unum sed aliqua, scilicet mobile et illa ad que se habet aliter quam prius", f. 31va. Oresme probably makes reference to the definition from Witelo's *Perspectiva*, as can be suggested by his attribution of this definition to the Polish scholar in Book III, *q.* 1. Ockham considered this definition not to be different from his own, see n. 8. For Buridan see A. Maier, *Zwischen*, 124-7.

[28] "Probatur: quia aliter se habere a ad b non est aliud quam a et b sic se habentia, sicut dissimilitudo est dissimilia et inequalitas est inequalia... Secundo, patet quod motus non percipitur nisi percipiendo plura aliter se habere, ideo signum est quod motus est illa plura", f. 31va. In the first *probatio* a theory (already refuted by Aristotle) according to which motion is an *inequalitas* is mentioned (it is recorded also in Aquinas' and Burley's commentaries).

[29] "Sed pono conclusionem oppositam, scilicet quod motus non est talia sic se habentia. Probatur quia nomina relativa vel relationes, sicut paternitas, inequalitas etc., non supponunt nisi pro uno sed connotant aliud, sicut paternitas pro patre, cuius signum est quia omnes qui ponunt quod non sunt accidentia distincta dicunt quod concretum et abstractum sunt nomina sinonima sicut pater et paternitas, ergo, quamvis motus sit connotativum, tamen supponit pro uno et connotat aliud, sicut pro mobili connotando illa ad que aliter se habet", f. 31va. In the margin of the manuscript an anonymous note ascribes to Ockham the position according to which "concretum et abstractum sunt nomina sinonima".

[30] See n. 29. The importance of connotation is evident also as far as the denotation of the term '*inequalitas*' is concerned: "Ad primam dico quod illa inequalitas non est

3a. Res permanentes and res successivae

The *con*-arguments opening this question concern problems different from those discussed in the first two opinions, but of a considerable importance in the medieval debate on motion; in addition, Oresme's own solution calls for facing some of these problems. As far as the following discussion is concerned, the most interesting of these problems can be summarized in four points: a) ontological problems (and particularly mereological problems) rising from the necessity of assuming the existence of parts which are at once past and future in order to maintain the continuity of motion (arg. 1 and 2[32]); b) the difference between motion and beings which are *tota simul* and so can be totally grasped in an instant is so great that the very existence of motion itself is exposed to the risk of being denied;[33] c) the difference of limits (*incipit/desinit*) following from these different ontologies; d) as far as only local motion is concerned, the difficulty of locating the place of motion in view of its continuity.[34]

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res realis, sed est realis connotando aliud, sicut exemplificatum est prius de paternitate", f. 31va.

[31] I should like to mention Henry of Ghent's theory of relations, opposing *res* and *modus rei*, see M. G. Henninger, *Relations. Medieval Theories 1250-1325*, Oxford 1989, 53. See also J. F. Wippel, *The Metaphysical Thought of Godefrey of Fontaines. A Study in Late Thirteenth-Century Philosophy*, Washington 1981, 232-6. It is not however possible to state precisely if Henry's or Godefrey's writings are the direct sources of Oresme. The same can be said for another possible source (John of Mirecourt) as well, mentioned in n. 20 and for Peter Olivi, who in some passages of his *Sentences* commentary quoted by A. Maier supports a theory of motion not far from Oresme's ("Die Bewegung ist eben kein reales Akzidens, sondern nur ein *modus essendi* (oder *modus se habendi*) des *mobile*"); see A. Maier, *Zwischen*, 314, 320, 329, n. 92 and namely 321 (for the quotation). It is worth pointing out that for Olivi the reference mark of the *modus se habendi* is external ("modus alius et alius se habendi ad aliquid extrinsecum"), a solution censured by Buridan and Oresme. As far as Roger Swineshead's outline of motion as *modus se habendi* is concerned see A. Maier, *Zwischen*, 133-4, n. 91.

[32] "Pars preterita motus non est nec pars futura ergo motus non est; consequentia tenet, quia totum non est aliud quam sue partes. Iterum, motus non est nisi medietas preterita et medietas futura, igitur si non sunt non est", f. 31ra.

[33] "Tertio, omne quod est est in hoc instanti, quia nihil est presens nisi instans, sed motus non est in instanti, quia non est nisi ante sit, sed non fit nisi in tempore igitur etc.", f. 31rb.

[34] "Quarto sic: si motus est tunc mobile movetur, verbi gratia motu locali; si sic, tunc queritur: aut movetur in loco in quo est, et hoc non, quia iam habet illud et per consequens non movetur ad illud, et etiam quia non est acquisitio partis post partem in loco in quo est; nec potest dici quod movetur in loco ubi non est", f. 31rb.

Replying to the first argument Oresme distinguishes permanent and successive beings — a very important distinction for his own solution in Book III, *q.* 7; he does not think, however, that this distinction is adequate to overcome the objection built into the relationship *totum/pars.*[35] Oresme's own solution — the *pars presens* consists of part of the past and part of the future — is close to Buridan's[36] and is recorded by Marsilius of Inghen in his commentary on the *Physics* as Oresme's position.[37] A solution to the same problem given later in Book III, *q.* 7[38] is probably more relevant: Oresme proposes to treat the problem of the relation between the whole and the parts for *res successivae* and *res permanentes* in two different ways: as far as the former are concerned, he considers this relation as being equivalent to that between points and a line or instants and a time interval.

The same distinction between *res successivae*, which are to be measured only in time, and *res permanentes*, which can be measured even in an instant, occurs in the reply to the third argument. Here Oresme — after pointing to some consequences following from the admission of ''*in instanti est motus*''[39] — refuses general validity to the principle ''*omne quod est, est in instanti*'' and is, therefore, forced to limit the principle ''*omne quod est in aliquo tempore est in quolibet illius temporis*''

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[35] Once one denied the existence of one part of the whole (in this case motion), one is forced to deny the other part because of the *significatus copulatus*: ''Sed contra: totum est due medietates; ergo, si prima non est, nec secunda, sequitur quod totum non est. Ad illud diceretur concedendo in sensu diviso quod prima medietas non est, nec etiam secunda, cum prima et secunda sunt de significato copulato, quia sunt ipse motus qui est'', f. 31va.

[36] ''Ideo aliter dico quod motus habet aliam partem quam medietatem preteritam et medietatem futuram, scilicet partem presentem, que componitur ex aliquo preterito et aliquo futuro; et ideo aliqua pars motus est sicut illa'', f. 31va. Buridan as well discusses this topic in Book III, *q.* 6 of his commentary on the *Physics*, in so far as the peculiar ontology of motion is concerned: ''secundo etiam ad hoc concludimus quod per presens oportet intelligere tempus divisibile cuius una pars est prius et alia pars posterius'', see Johannes Buridanus, *Questiones*, f. 48vb.

[37] ''Respondetur negando consequentiam, quia est aliquis motus qui nec est preteritus nec futurus sed compositus ex preterito et futuro, hic dicens Orem'', Johannes Marsilius de Inghen, *Questiones subtilissime super octo libros Physicorum*, Lyon 1518, (repr. Frankfurt a. M. 1964) Book III, *q.* 2, f. 36vb.

[38] A different mereology for *res permanentes* and *successive* is required by the definition of *successivum simpliciter* in Book III, *q.* 7, see n. 69.

[39] ''Ad tertiam dicunt aliqui quod motus non est in instanti, sed tamen in instanti est motus. Contra: in instanti est motus ergo dum instans est motus est; et sequitur ultra: ergo in instanti est tempus; et ultra: ergo subito est tempus; et iterum: ergo acquisitio partis post partem est in instanti sicut motus; ultra: ergo in hac mensura est motus, ergo mensuratur et continetur tali mensura, sicut in hoc loco est corpus ergo corpus continetur in hoc loco'', f. 31va.

(*Phys.*, VI, 6, 236b 19-23).[40] Sentences such as "*motus est*" also require a certain amount of time for their verification.[41]

4. *Opinio III: "motus est mobile seu res mota"*

Even though the term '*mobile*' is not ambiguous, Oresme thinks it appropriate in the *notabilia* preceding the *pro*-arguments to state precisely that the *res mota* this opinion refers to is not to be regarded as something different from the *mobile*, like a sort of accident qualifying the substance as a moving one[42]. That a *res*-theory is the constant target of this opinion is unequivocally confirmed by the two last *pro*-arguments, and mostly by the fourth, in which such a special being (here called *fluxus*) postulated by a *res*-theory, is thought to involve a never-ending regress.[43]

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[40] To be interpreted as referring exclusively to *res permanentes*: "et forte melius diceretur quod intelligit de rebus permanentibus, quia revolutio diurna est in una tota die et non in aliqua parte, quia successiva non sunt mensurabilia nisi tempore", f. 31vb.

[41] "Et tunc ultra quod continue hec est vera: 'motus est'; potest dici quod numquam est vera in instanti, sed per tempus, sicut non est ita in re sicut ipsa significat nisi per tempus", f. 31vb. Buridan deals with a similar problem in Book III, *q.* 6 of his commentary on the *Physics*; see Johannes Buridanus, *Questiones*, f. 49rb.

[42] "Secundo, sciendum quod potest intelligi quod motus est mobile uno modo, scilicet quod res moveatur motu distincto et superaddito, et ille motus sic movetur vel alio motu vel se ipso, et tunc esset alia res mota que non esset motus... et sic non intelligitur ista opinio prima. Alio modo intelligitur quod omne quod movetur movetur se ipso formaliter, ita quod non sit aliquod accidens vel fluxus inherens. Et sic intelligitur positio, et tunc res mota est motus et e converso", f. 31vb.

[43] "Ducendo ad impossibile, suppono primo cum adversario quod motus est talis fluxus distinctus. Secundo, quod non ponitur nisi quia est illud quo aliquid continue se habet aliter et aliter ad aliquod non motum; et ideo dicit Lincolniensis quod est exitus de potentia ad actum et dicitur quod est via, id est quo fit. Contra: sit a mobile et b sit ille fluxus; tunc sic: prius est verum quod b non est in a et postea quod b est in a, ergo a est mutatum ad ipsum b, ergo per suppositionem secundam hoc est per mutationem distinctam a subiecto et termino, quia propter aliud non ponitur, ergo motus erit motus, et sic proceditur in infinitum, quod est contra Aristotelem septimo huius. Et si dicatur quod se ipso mutatur ad b sine mutatione superaddita ergo etc., hoc est contra secundam suppositionem et pari ratione mutabitur a sine quocumque fluxu superaddito", f. 32ra. As far as the instantaneous change is concerned, the superfluity of a *res superaddita* is demanded by the principle of parsimony ("Frustra fit per plura ubi sufficiant pauciora", f. 32ra). Once admitted, untenable philosophical or theological consequences follow; in the former case the existence of a purely instantaneous res must be admitted ("Tertio, probatur de mutatione subita, quia si esset res superaddita, tunc duraret solum per instans, quod Aristoteles octavo huius reputat impossibile, quia simul inciperet et desineret esse", f. 32ra); in the latter God's creation of a single being produces a never ending chain reaction ("Item etiam Deus non posset creare unam rem solum quin causaret multas", f. 32ra).

As an anonymous copyist has recorded in the margins of the Seville manuscript, one of the most renowned supporters of this opinion is William Ockham, but already Averroes had maintained that this was Aristotle's own solution. Even if it can not be traced back exclusively to Ockham, it is highly probable that his position is envisaged in this opinion. This assumption is grounded not only on the assignment of '*motus*' to connotative terms, but also on the fact that the term '*motus*' is considered to have been coined for the sake of economy and elegance in speech in order to avoid dangerous misunderstandings.[44] Moreover, a large number of solutions to the *dubia* in this question indulge in a logical and semantic analysis of the different problems raised by this opinion.

From this third question to the seventh, the number of the arguments following the *titulum* is sharply reduced; they are replaced by a series of *dubia* within the questions immediately followed by their solutions. In the present question the capacity of this third opinion to solve some objections is revealed through some fourteen *dubia*; but above all it is shown how this opinion is not at variance with some of the definitions of motion by Aristotle, Averroes and, among the Latins, Robert Grosseteste — whose authority in this discussion is confirmed by the constant use of his solution throughout the different *opiniones*.

The definitions that are opposed, as *dubia*, to this third opinion are the following: a) ''*motus est actus mobilis*'' (in connection with which other *formulae* like ''*corpus est motum*'', ''*motus est forma mobilis*'', ''*motus est accidens*'', and ''*motus est quantitas*'' are discussed); b) ''*motus est actus entis in potentia secundum quod huiusmodi*'' (here we find in the following discussion Grosseteste's definition: ''*motus est exitus de potentia ad actum*''); c) ''*motus est actus imperfectus*'' (on this occasion Averroes' definitions are dealt with: ''*motus componitur ex ente et non ente*'' and ''*motus est medius inter potentiam et actum qui est perfectio potentie*'').

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[44] ''Sciendum primo quod 'motus' est nomen connotativum et quod propter breviloquium ponitur loco unius dictionis sicut illius vel consimilis ''mobile se habet continue aliter quam prius respectu cuiuslibet non moti'', et hoc vel secundum qualitatem vel secundum locum et sic de aliis. Et pro eodem supponit concretum et abstractum, scilicet 'motum' et 'motus', et ita connotat res extrinsecas'', f. 32ra. A text from Averroes' commentary on the *Physics* is interpreted as a confirmation of the propositional nature of '*motus*': ''Et per hoc glosatur dictum Commentatoris quarto Metaphysice dicentis quod motus componitur ex ente et non ente, quia ad hoc quod sit verum quod hoc moveretur requiritur quod quedam negativa sit vera et quedam affirmativa'', f. 32rb.

The replies to these *dubia* highlight the importance of penetrating the real meaning of the different definitions, discriminating neatly the ontological and the logical sphere. Thus, we find this distinction in definition a) above, where two different meanings of the word '*actus*' are proposed:

> actus accipitur dupliciter in proposito: uno modo pro aliqua forma informante... alio modo improprie pro aliquo predicabili vel subicibili, quod a natura verificatur in actu et improprie non de facto, id est in presenti, sicut dicimus quod paternitas est actus patris; et isto modo motus est actus.[45]

It is worth noting, finally, how in his replies to the *dubia* Oresme expresses the solution proposed by this third opinion in terms of "*aliter se habere quam prius*", that is in terms of the solution he will put forth as the more probable in Book III, *q.* 7.[46]

5. *Opinio IV: "res acquisita mobili dum movetur"*

The fourth opinion is discussed more extensively than the others, taking up two whole *quaestiones* in which alteration and augmentation/diminution (III, 4) are dealt with separately from local motion (III, 5).

The opinion in question relies upon Aristotle's *Physics* V, 1, 224b 7-8[47] and, in terms of this particular Aristotelian text, the most suitable denotation of '*motus*' appears to be "*res acquisita mobili dum movetur*". As far as alteration and augmentation/diminution are concerned, this solution is not far removed from the previous one: the body altered or augmented/diminished being the precise equivalent of the *mobile* in local motion. It is, however, exactly local motion that creates problems for this fourth opinion, because in local motion nothing new is acquired as it is in the case of alteration or of augmentation/diminution, given that the space traversed is preexistent in local motion.

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[45] F. 32ra. The connotative power of '*motus*' plays a very important role in clarifying the various definitions of motion such as "*motus est quantitas*": "Et etiam quod est quantitas, quia connotat mobile sic se habere per tempus longum divisibile, quod dicitur quantitas divisibilis, et sic de similibus", f. 32ra.

[46] See n. 44-45 as far as the first two *dubia* are concerned; for the third: "Imperfectum est illud quod natum est habere aliquid quod nondum habet, et mobile dum movetur est natum esse in loco in quo nondum est ad quod tendit sine quiete media; et secundum hoc, cum sit perfectibile per illum modum se habendi, dicitur imperfectum, quia partem habet vel habuit de illo ad quod movebatur et pars restat habenda. Et quia motus indicat et significat mobile sic se habere, ideo dicitur actus imperfectus, id est predicatum connotans aliquid futurum", f. 32rb. For Ockham himself "*aliter se habere quam prius*" is equivalent to his own solution, see above, n. 8.

[47] As clearly stated in Book III, *q.* 4: "Oppositum patet, quia motus est de genere termini ad quem", f. 32va.

5a. Book III, quaestio 4

This opinion no longer favours anymore a *res*-theory solution, as is confirmed by the two first conclusions concerning, respectively, *motus acquisitivus*[48] and *deperditivus.*[49] In the third and last conclusion a process of acquisition or loss (''*non semper est motus, sed solum dum acquiritur*'') is required for motion, whose connotative power is stressed as in the previous opinion.

The objections against this opinion are not numerous,[50] being less than half of those in Book III, *q.* 3. Nevertheless, some of them do deserve attention: in the first — ascribed to Ockham's followers in a marginal note in the manuscript[51] — the opinion in question is confronted with a casus in which a simultaneous acquisition and loss of two different qualities in the same body seems to force one to conclude that two contrary motions are in the body at once, which is untenable. In reply, the simultaneous *intensio* and *remissio* of two different qualities are not considered to be contrary at all, and even space is not regarded as having absolutely fixed *termini*, a remark which covertly, even if not explicitly, might have been raised against Aristotle.[52]

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[48] ''Motus est acquisitio ergo est res acquisita; consequentia tenet, quia in aliis est ita, sicut successio diei non est nisi dies. Item, sicut tempus est successio dierum et numerus unitatum non est preter unitates, ita motus non est nisi acquisitio partium que non est preter partes'', f. 32vb. The consensus with authority is pursued also in this first conclusion: ''Probatur primo, quia Commentator dicit quod motus est generatio partis post aliam illius passionis ad quam tendit mobile donec perficiatur et fiat in actu; et subdit necesse est quod motus qui est in substantia inveniatur in genere substantie, et ita de aliis...Item Aristoteles hic dicit expresse quod motus non est preter res et exemplificat de rebus acquisitis, sicut est in augmentatione; ita per simile est in aliis, sed augmentatio est res addita et acquisita, unde dicit 'preexistenti quantitati additamentum', modo 'augmentum' vel 'additamentum' non est nisi res addita per communem usum et non illa cui fit additio'', f. 32vb.

[49] ''Sicut est in diminutione ita est in aliis; modo diminutio non est nisi distinctio seu subtractio quantitatis, modo diminutum non est nisi res que abicitur vel illud quod abicitur ab aliqua re vel res abstracta'', f. 32vb. In these arguments some untenable theological or physical consequences are recorded: as far as the former is concerned, if motion is something different from mobile, a never ending regress is caused by a God's single intervention (such an argument can be found in the first conclusion too); for the latter, when light is corrupted, one is forced to assume that this *res superaddita* is produced by the agent: ''Tertio, in alteratione que est obtenebratio vel umbratio vel lucis subtractio talis motus est deficiens, sicut patet, quia nulla res ibi acquiritur vel inducitur; modo si motus est aliquid aliud superadditum, iam illud induceretur a motore'', f. 32vb.

[50] In these *dubia* the following sentences about motion are explained according to the solution proposed in this fourth opinion: ''motus est actus in potentia secundum quod in potentia'', ''motus est actus imperfectus'', ''motus est actus mobilis'', ''motus est perfectio mobilis'', ''motus est compositus ex affirmatione et negatione'', ''motus est actio motoris'', ''motus est passio in passo'', ''mobile habet perfectionem in actu non secundum quod est motus et passionem secundum quod dicitur in potentia secundum quod est motus'', ''motus est exitus de potentia ad actum'' (from Grosseteste). The fourth opinion's solution is able to warrant also ''*motus est sensibilis*'', see f. 32vb.

In the second and in the third arguments some semantic problems are dealt with and solved, relying upon the connotative power of various terms. Thus, in the second argument two contrary motions like *illuminatio* and *corruptio luminis*[53] have, in accordance with this fourth opinion, to be judged as "*motus eiusdem speciei*", being both referred to *lumen*. In the third argument, the difficulties raised by the denotation of negative terms like '*deperditio*' are examined by appealing to the connotative import of terms used to qualify the results of these motions.[54]

5b. Book III, quaestio 5

The main problem for the fourth opinion is to account for local motion, because no alteration takes place in the *mobile*. Thus, the first of the three hypotheses proposed in this question suggests an entirely different solution for this kind of motion, accepting, as far as local motion is concerned, the third opinion. In order to overcome the difficulty of the evident difference between alteration, augmentation/diminution, on the one hand, and local motion, on the other, Oresme analyses three different hypotheses. In the first, local motion is considered a special case which can not be included in this fourth opinion, just because nothing new is gained through such motion:

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[51] "Tunc contra quartam opinionem surgit glosa ochanica", f. 32vb, marg. int.

[52] "Ideo non dicitur aliquid esse sursum vel deorsum nisi in respectu. Et consimiliter, si diceretur quod contraria non sunt simul, tunc idem diceretur calidum et frigidum solum in respectu, non quia haberet duas qualitates, et sic moveretur solum uno motu, qui respectu unius diceretur intensio et respectu alterius diceretur remissio", f. 33ra.

[53] "Solutio: dico quod nomina connotativa dicuntur diversarum specierum et etiam generum propter diversas connotationes et non propter significata pro quibus supponunt", f. 33ra.

[54] "Solutio: vel est solus acquisitivus et denotatur ab illo, vel deperditivus et tunc est deperditum, sed denotatur a nomine illorum que consequuntur illum motum, sicut 'corruptio' vel 'tenebratio', quia secundum hoc dicitur 'terminus ad quem', quia motus est ad hoc ut talis res non sit", f. 32ra.

> tunc de questione possunt esse tres ymaginationes speciales. Prima est quod in motibus aliis, ubi aliquid acquiritur vel deperditur, motus est quod acquiritur vel deperditur... Sed in motu locali, per quem nihil fit de novo, motus est mobile, ita quod si motus vel spatium generaretur de novo tunc motus esset spatium, sed quia non est, ideo mobile.[55]

Oresme refutes this solution, because it prevents a unitary definition of motion:

> contra arguitur, quia non videtur si in uno motu motus est illud quod acquiritur quin etiam in alio, maxime quia descriptio generalis motus est univoca.[56]

The importance of Oresme's firm warning against different solutions concerning different kinds of motion is to be emphasized. In all probability, this warning is not simply a general one, because Buridan — admittedly on different grounds — had already proposed dealing with alteration and augmentation/diminution separately from local motion, a proposal which will be, at least partially, accepted by Albert of Saxony.

The second hypothesis, considered by Oresme "*multum rationalis*", because it is particularly suited to the avoidance of the absurdities that follow from the others, identifies the *res* acquired through local motion with the space "*interceptum inter latera continentis*". It is, however, abandoned because it is an unusual imagination, but above all because it is refuted as untenable by Aristotle.[57]

In the third hypothesis, which is deemed more probable and therefore more adequately tested by the *dubia*, the denotations of '*motus*' are the different spaces occupied by the *mobile* during its motion.[58] In this case the *dubia* concern only physical problems with no hint of Aristotle's, Averroes' or Grosseteste's definitions.[59]

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[55] F. 33rb.

[56] F. 33rb.

[57] "Alia est imaginatio multum rationalis, si esset usitata, quod motus localis est locus non continentis, sed spatium interceptum inter latera continentis; vel saltem quod motus localis non est aliquid, sed esset tale spatium si esset. Et secundum hoc, ponendo tale spatium, non oporteret concedere aliqua absurda que conceduntur secundum alias vias, sed tamen, quia hoc est expresse contra Aristotelem qui improbat illam opinionem, ideo conformiter ad precedentem questionem", f. 33rb.

[58] "Tertia imaginatio est quod motus localis est locus ipsius mobilis dum acquiritur mobili successive, vel plura loca, scilicet medium per quod movetur vel saltem ad quod se habet aliter quam prius circa quod movetur", f. 33rb. It is noteworthy how in this case motion is explained in terms of "*aliter se habere quam prius*".

6. *Opinio V:*[60] *"motus est res successiva distincta simpliciter a permanentibus"*

The fifth and last opinion, in which the denotation of '*motus*' is a *res successiva sive fluxus*, is very important because, as Oresme declares at the end of the following question, if properly interpreted it is the most probable solution to the problem of motion; if, on the contrary, this *fluxus* is regarded as a distinct form it is the worst solution.[61] In order to be able to denote a form inhering to the *mobile*, '*motus*' has to be considered an *incomplexe significabile* (as unequivocally required by the *notabilia* of Book III, *q.* 1, where it is clearly stated as well that it is not the case). Oresme's solution, which anticipates the most probable opinion put forward by him in the following question, is grounded on the identification between *fluxus* and *modus ipsius mobilis*:

> ex predictis potest elici quinta opinio, scilicet quod motus est res successiva distincta simpliciter a permanentibus. Et potest dupliciter intelligi: primo, quod sit una res inherens significabilis incomplexe sicut una forma, et sic non est verum; secundo quod sit conditio vel modus ipsius mobilis, et sic est verum.[62]

In order to win for the *fluxus* a non "realistic" perspective, Oresme proceeds by distinguishing three different meanings of '*successivum*' inside an extended ontology — which includes, in addition to substances and accidents, the *modi rerum* — beings, qualities and *modi rerum* which are successive in the strictest acceptance of the term.

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[59] Most solutions rely upon a deep analysis of the meaning of various terms. Some passages concern the meaning of '*velox*' ("'velox' consignificat motum acquiri in pauco tempore", f. 33rb) and the criterion according to which two different velocities are compared ("equalitas velocitatis non attenditur penes totum acquisitum, sed penes lineam qua mensuratur distantia, sicut conformiter in motu alterationis", f. 33va).

[60] In the *con*-argument Averroes' distinction between *fluxus formae* and *forma fluens* is considered as one of the sources of this opinion: "Oppositum patet, quia motus est in genere passionis et Commentator distinguit quod capitur pro fluxu forme aut pro forma fluente, ut patet commento quinto", f. 34vb.

[61] "Alia que ponit quod est fluxus ad modum unius forme distincte, sicut esset albedo vel anima vel aliquod tale, est omnium pessima; tamen si intelligatur quod non sit talis forma vel talis res, sed modus vel conditio ipsius mobilis, tunc esset verissima et probabilior et facilior inter omnes et concordat dictis Aristotelis et philosophorum", f. 34vb. Even though no explicit reference is made to Buridan, I think that in this fifth opinion Oresme has in mind exactly his position; the mention of *albedo* (quoted explicitely by Buridan in the text of n. 3) is too generic to be considered an allusion to Buridan's commentary on *Physics*.

[62] F. 34ra. The twofold meaning involves in some way the opposition between res inherens/incomplexe significabile and modus rei/complexe significabile. The interpretation of *fluxus* as a *conditio vel modus ipsius mobilis* prevents one from considering it as a *res distincta simpliciter a permanentibus*, see also n. 71.

In the first acceptance of '*successivum*', where the *mobile* is labelled as *successivum improprie*, we probably find the first hint at a different solution from that of the third opinion:

> successivum dicitur tripliciter: primo, improprie pro re permanente que successive secundum equale esse, sicut mobile dum movetur, dicitur successivum, quia succedit per diversa loca...Alio modo minus improprie pro re cuius pars est in facto et pars alia est acquirenda vel in acquiri sicut caliditas dum acquiritur dicitur successiva...Et tertio pro eo quod in nullo tempore sic se habet quod illud quod fuit in prima parte est in secunda parte, sed quolibet tempore accepto in una parte illius est aliquid tale illius successivi et in alia totaliter aliud, et sic est ymaginandum de tempore, quia prima pars non est quando secunda est, ideo tale dicitur non permanens sed in continuo fluxu et transitu.[63]

In the third *distinctio*, the *modi rerum* make, if not their first, certainly their official, appearance in addition to substances and accidents; it is a very important statement, because in the next question Oresme proposes them as the proper denotation of '*motus*':

> alique forme sunt per se existentes, alie sunt forme accidentales... alie sunt que dicuntur conditiones vel modi rerum vel taliter se habere sicut quedam relationes et huiusmodi.[64]

Oresme's main effort in the following conclusions is precisely directed to locating successive (in the strictest sense[65]) beings, qualities and *modi rerum* in this kind of ontology: the first to be considered is the weakest form of ontology, that is the *modi rerum*, which include motion and time.[66] *Illuminatio* and *sonus* are the examples as far as qualities are concerned (accidental forms). It is not so easy, nevertheless, to single out a *res pure successiva* in the category of substance; in the example Oresme proposes he is forced to resort to a very special casus in which God is imagined to create a being, presumably a man, at each instant of a continuously changing proportion.[67] This created being as a whole (*aggregatum ex omnibus istis*) should be looked at as a successive (in the strictest meaning) substance, but it is difficult to see how this aggregation could be considered a single man, as the text seems to suggest.[68] In the following corollary, Oresme tries to soften such a difficulty by claiming for continuous beings a mereology completely different from that of permanent beings, quite similar to that regulating the relationship between a divisible whole and its indivisible parts, like a line and its points or a time interval and its instants.[69]

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[63] F. 33vb. In the second *distinctio* a further distinction refers to the difference between a *secundum quid* and an absolute meaning, which is identical with the second and third acceptances of the previous threefold distinction: "Adhuc successivum dicitur dupliciter: uno modo secundum quid et categorematice, quando non permanet secundum totum, tamen aliquod eius semper est permanens sicut illud cui fit continua additio in quolibet instanti est aliud et aliud secundum totum. Alio modo dicitur successivum simpliciter et sincategorematice quod nec secundum se nec secundum aliquid sui permanet per aliquod tempus, sicut ymaginaretur de motu et tempore", ff. 33vb-34ra.

[64] F. 33vb. See also n. 31 as far as relations are concerned.

[65] The *successivum secundum quid* raises no problem: "rationabile est esse aliquod successivum secundum quid seu sit conditio rei vel sit verus motus. Unde possibile est quod in quolibet instanti in aliquo tempore sit nova figura secundum totum. Similiter si sit accidens sicut caliditas, quando intenditur; unde in quolibet instanti est aliqua que nondum fuit, licet pars eius prefuerit. Similiter etiam in substantia, sicut in inanimatis, quando ignis comburit aliquod successive, tunc in quolibet instanti est aliquis ignis qui non fuit ante nec aliquid permanet secundum se totum", f. 34ra.

In the ensuing discussion (where the *dubia* are not used to confront the position in question with authoritative definitions as in the previous questions), *res* and *modus rei* are carefully discriminated. In the first *dubium* Oresme maintains the equivalence between *fluxus* and "*aliter se habere quam prius*", here called *modus rei*, to the extent that this opinion — the truest if properly interpreted — is very similar to Oresme's own solution in the following question.[70] The hypothesis according to which the *fluxus* is a *res distincta* from the *mobile*, upheld in the second, fourth and sixth objections, has untenable physical (ob. 2 and 6 with a never-ending regress[71]) or theological (because God could not create anything without such a *fluxus*, ob. 4[72]) consequences.

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[66] "Secunda conclusio est de successivo simpliciter, quod est aliqua conditio simpliciter successiva. Probatur primo de motu, et est manifestum in motu locali quod mobile continue est in alio et alio loco et quod continue se habet aliter et aliter a se", f. 34ra. The continuous changing of a proportion seems to be a purely continuous being of this kind: "Secundo, sit a quantitas maior et b minor et diminuatur a successive; tunc in quolibet instanti a ad b habet aliam et aliam proportionem ergo talis proportio que est per totum tempus dicitur successiva et quidam modus se habendi successivus et in nulla parte temporis habet taliter esse qualiter se habet in sequenti, ergo est simpliciter successivum iuxta expositionem prius positam", f. 34ra. A similar example, with particular reference to the denotations of terms according to which the comparison is drawn, is to be found in the fourth conclusion, see the following footnote. It is in any case noteworthy to stress how the set of the changes in the proportion between two elements is — like motion — a *res pure successiva*, different from the elements compared and presumably not inhering to them.

[67] "Quarta conclusio: quod non implicat contradictionem nec est simpliciter impossibile quod sit aliqua substantia simpliciter successiva. Verbi gratia: si a quod est duplum ad b diminuatur successive, non est contradictio quod Deus creet unum subiectum vel hominem qui precise duravit quamdiu a erit duplum, scilicet per solum instans, et similiter quando erit sesquialterum, et sic de qualibet alia proportione; igitur tale aggregatum ex omnibus istis esset homo vel substantia successiva cuius nihil quod erat in aliqua parte temporis fuit in sequenti", f. 34ra.

[68] A very similar example is mentioned in Albert's of Saxony commentary on the *Physics*, Book III, *q*. 3: "non implicat contradictionem quod substantia aliqua sit simpliciter successiva, hoc est de termino substantiali significative accepto verificetur ly ens simpliciter successivum. Patet, quia non implicat contradictionem, immo forte ita est quod Sor continue fit vel producitur a prima causa recte sicut lumen vel species coloris vel visibilis continue est alia et alia imago seu species, sic continue Sor est alius et alius homo", Albertus de Saxonia, *Questiones*, f. 35ra.

[69] "Et dico correlarie quod in talibus illud quod est solum per instans non est pars illius successivi, sed se habet ad illam sicut punctus ad lineam et instans ad tempus", f. 34ra.

The equivalence between *fluxus*, "*aliter se habere quam prius*", and *modus seu conditio rei* anticipates Oresme's own solution in the following question.

7. *Oresme's own solution: "motus est aliter se habere quam prius"*

In addition to the various definitions of '*motus*' examined in the different opinions, from the beginning of this discussion Oresme has constantly resorted to the description "*aliter se habere quam prius*". Oresme's proposal of a new definition of '*motus*' aims to mediate between the different opinions previously discussed and is therefore more general, so much so that the others, as we have seen, could be formulated in terms of "*aliter se habere quam prius*".

This opinion, like the previous ones, is obviously not favourable to a *res*-theory, and for this reason it is essential to gain a precise determination of the meaning of "*aliter se habere quam prius*". It is a delicate point in the discussion, because Buridan had grounded his betrayal of the "nominalist" cause as far as local motion is concerned just because he needed to suppose a "reference mark" inside the *mobile* in order to solve the casus of a rectilinear motion of the universe as a whole; this internal reference mark, called sometimes disposition, is, according to Buridan, different from the *mobile* and inhering to it.

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[70] That is clearly stated in the reply to a *con*-argument according to which *fluxus* is not able to explain motion: "Sed videtur quod non, quia sufficit quod illa se habeant aliter quam prius. Sed hoc est concedere propositum, quia postquam oportet quod ita sit in re quod aliter se habeat quam prius, illud 'aliter se habere' vocatur 'modus rei'", f. 34rb.

[71] "Secundo, talis res exit in esse sine additione superaddita sibi, quia tunc esset processus in infinitum... Solutio: negatur consequentia, quia motus non ponitur talis res, sed solummodo modus quo aliquid se habet dum acquiritur aliquod esse", f. 34rb.

[72] "Quarto, Deus non posset annichilare unam rem successive quin crearet aliam, scilicet illum fluxum, et sic posset argui de creatione, quod non posset creare unam quin crearet duas", f. 34rb. If properly understood as a *res pure successiva* and *aliter se habere quam prius*, *fluxus* can not be separated by motion, neither by God's absolute power: "tertio, sint tres: aqua, ille fluxus et caliditas in alteratione; tunc si Deus poneret caliditatem in aqua circumscribendo illum fluxum, tunc alteraretur sicut nunc, ergo frustra ponitur talis fluxus. Responditur negando casum, quia, sicut Deus non potest facere quod aqua calefaceret successive quin haberet se aliter et aliter, ita nec potest tollere illum modum se habendi in casu posito", f. 34rb.

Oresme presents five different solutions concerning the proper meaning of "*aliter se habere quam prius*" and discusses the different problems raised by them. Firstly, a generic formulation prevents one from differentiating beings in motion from beings at rest, since the latter change their position with respect to the beings in motion. The second solution, according to which the reference mark is fixed in one or more beings at rest ("*continue se habere aliter ad aliquid quiescens*"), is refuted by Oresme on two different grounds: a formal (because of a *petitio principii*, rest being explained in terms of motion[73]) and a physical one, supposing that the whole set of beings is moved.

As far as the physical objection is concerned, it is very similar to the one put forward by Buridan who holds the *mobile*-theory untenable as far as local motion is concerned, preferring instead a *res superaddita* inhering in the *mobile*. Notwithstanding the complete overlapping of Buridan's and Oresme's solutions to this problem (both are for an internal reference mark) and to the more general problem of motion (for both the denotation of '*motus*' is a *res pure successiva*), Oresme explicitly criticizes the inherence of this *res successiva* to the *mobile*. There is in Oresme's text no overt criticism of Buridan, but in Book III, *q*. 6 he deems the *fluxus*-theory to be the worst theory when the *fluxus* is interpreted as a *res superaddita* inhering in the *mobile*. Another element in Oresme's position permits one to grasp the difference between this position and Buridan's: Oresme is convinced that the *fluxus*, properly interpreted as a *modus seu conditio ipsius mobilis*, could in no way be separated from *mobile*, not even by God's absolute power.[74]

This difference between Buridan and Oresme lies in the different features assumed by *fluxus* in their respective texts: even though they agree about its successiveness (*res successiva*), for Buridan it is something very nearly an accident (or anyway near to an accidental form), while for Oresme it is a *modus seu conditio* of one and the same *mobile*. Oresme moreover does not hint at either the Parisian condemnation of 1277 or God's absolute power.[75]

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[73] "Primo, quia tunc esset petitio principii, quia queram quid est quiescere; et cum sit privari motu, non potest describi nisi per moveri", f. 33rb.

[74] See n. 72. The same remark is to be found in the appraisal of the third opinion in Oresme's final review of the different solutions in Book III, *q*. 7, see below, n. 92.

The fourth solution[76] takes up the issue of the imagined space discussed in Book III *q.* 5 (where it is considered as a very rational hypothesis[77]), and refutes it as untenable because it is contrary to Aristotle and in any event not general enough to be utilized for all kinds of motion.[78]

The "*melior et vera*" solution, the fifth, leaves out of consideration the external reference marks and thus the "*aliter se habere quam prius*" refers exactly to a reference mark within the *mobile*:

> quinta descriptio melior et vera est quod moveri est aliter se habere continue quam ipsum mobile prius se habebat respectu sui et non respectu cuiuscumque extrinseci.[79]

The importance of this move clearly emerges from the *suppositiones* following the conclusion in which Oresme refuses to consider '*motus*' a *res permanens*:[80]

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[75] Oresme relies upon Aristotle's *Meteorologica* and Averroes' commentary to *De caelo* for the possibility, respectively, of the motion of the heavens (together with the elements, earth excluded) and the motion of the earth. The latter is attributed to the uninterrupted interaction between contrary qualities, which is responsible of the continual change of the centre of gravity as to the centre of the earth. In the third argument the simultaneous change of all changeable beings is imagined, see f. 34va. The resort to *casus divini* is limited to the last argument, where God is entitled to move something, even if it is the only existent being in the world, lacking thus any external reference mark: "Quarto sic: si sit tantum unum corpus Deus posset illum movere et nullum esset quiescens", f. 34va.

[76] The third solution is an extended form of the second: "Tertia descriptio est quod moveri est aliter se habere ad aliquod quiescens si est vel si esset", f. 34va, for which the previous objections are valid.

[77] See n. 57 above.

[78] "Quarta descriptio est quod est aliter se habere ad aliquod spacium ymaginatum, quod esset vacuum si non esset ibi corpus. Ista non valet: primo, quia per Aristotelem non est ponendum tale spatium ymaginatum quia nihil est. Etiam illa descriptio non esset nisi de motu locali, quia illud quod alteratur non se habet aliter ad tale spatium, et ita non est generalis", f. 34va.

[79] F. 34va. In the two following *probationes*, Oresme imagines the motion (local and qualitative change as well) of only one being, as in the only previous argument where God's absolute power is quoted, see above, 75.

[80] "Pono conclusionem quod motus est quedam mutatio preter res permanentes que est successiva, exponendo 'successivum' sicut prius", f. 34va.

> suppono aliqua: primum est quod nulla duo possunt invicem se habere aliter quam prius nisi alterum sit mutatum aliquo modo. Secundum est quod aliquid potest aliter se habere ad aliud sine eo quod ipsum est mutatum, sicut aliquid sit simile vel dextrum solum per mutationem alterius, et tunc est in eo quedam conditio relativa que non fuit ante. Tertium est quod nihil se habet aliter quam prius respectu sui ipsius nisi sit mutatum. Quartum est quod esse sic mutatum respectu sui ipsius habet aliquam conditionem quam prius non habebat.[81]

The *mobile*'s continuous internal changes, which for Oresme are the different *modi* or *conditiones*, are the *res successiva* required for explaining the meaning of '*motus*'[82].

Oresme proposes the explicit equivalence between motion and *modi* or *conditiones* of the *mobile* in the final remarks of the *casus* of a single body moving and being at rest alternately for an hour; it is not possible in this case to point an external reference mark in order to establish the different position of the body:

> ergo in se ipso habet aliquam conditionem que non erat ante, et hoc vocatur 'movetur'.[83]

In the third argument in favour of the equivalence between motion and *modus* or *conditio* of the *mobile*, Oresme maintains that only this kind of solution may certify the motion of the heavens and the condition of rest of the earth, given that their reciprocal position is also explicable through the earth's diurnal motion.[84] Even the presence of the mover's force is not enough for Oresme to establish which of two bodies is moving,[85] because in a complex system of moving bodies —

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[81] F. 34va.

[82] An example in the reply to the first objection is very important to the understanding of Oresme's position: "Quia solum est illud quod mobile habet esse uno modo, id est habet unum modum se habendi, et alias habet alium modum, et secundum hoc dicitur alterum a se improprie, sicut dicimus quod Sor sedens est alter a se ipso stante, vel differt a se ipso stante", f. 34va.

[83] F. 34va. We find the same thing in the reply to an objection: "Secundo, arguitur sic: sint duo corpora a et b et a moveatur circulariter et b quiescat in prima hora, et in secunda e converso: tunc a non se habebit aliter ad b in una hora quam in alia, sed omnino eodem modo, in tantum quod nullo sensu posset percipi quid eorum movetur, igitur pari ratione qua unum movebitur et alterum, nisi in uno ponatur aliqua conditio que non erit in alio, et hoc vocatur 'motus'", f. 34va-b.

[84] "Tertio, non esset aliqua ratio quare terra non moveatur motu diurno et celum movetur quam e converso; consequentia patet, quia omnis habitudo unius ad alterum et aspectus qui fit ex motu celi fieret ex motu terre, ideo, sicut dicebatur prius quod motus non est sensibilis, ideo non posset experiri utrum terra moveatur circulariter aut celum", f. 34vb.

[85] "Sed diceretur ad ista quod quando sunt duo et unum movetur et alterum quiescit, quod illud movetur cui movens applicatur et virtus sua, et sic non oportet ponere aliquam conditionem", f. 34vb.

like that proposed by Oresme of a man on a ship, running in the opposite direction to the ship's motion — the *virtus motiva* could not represent an effective criterion.[86]

It is only a hint, but it is nevertheless noteworthy, because as Maier has already pointed out,[87] even though it is not appropriate to interpret this position (rather than *impetus*-theory) as a precursor of the modern law of inertia, the motion regarded as a *modus rei* could in fact have fostered a more kinematic analysis of motion.

We have already seen how Oresme's proposal is largely indebted to the *fluxus*-theory of the fifth opinion, which a new interpretation brings into the "nominalistic" field; the other opinions as well, however, could have contributed to the establishment of his own solution. He does not in any case excuse himself from reviewing them at the end of this question, in which he puts forth his own solution. In order to establish through his appraisal of these opinions a possible conceptual route to his own solution, it is worth mentioning these last remarks.

Relative to the first opinion, the denial of motion is grounded upon the limitation of one's ontology to merely *res permanentes.*[88] The second opinion, even if regarded unenthusiastically ("*licet parum valeat*"[89]), is according to Oresme meritorious for claiming more than a single element in explaining motion; the epistemological analysis in Book III, *q.* 1,[90] in which motions turns out to be a *complexe significabile*, confirms the solution of this second opinion and the importance of such a move for the polemic against a *res*-theory. The fourth opinion too deserves attention, even if only as far as alteration and augmentation/diminution are concerned; Oresme openly criticizes its refusal to consider the *mobile* as the denotation of '*motus*' in local motion.[91]

In order to better comprehend Oresme's own solution, by far the most important opinions are, nevertheless, the third and the fifth. The former is never overtly opposed by Oresme, who disagrees only with its identification of "*aliter se habere quam prius*" with *mobile*; in any event, praise exceeds criticism and Oresme seems to think that this third opinion is the most determined (or the most powerful) in the struggle against a *res*-theory.[92] The fifth, properly understood is, as we have already seen, the best and the truest one.[93]

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[86] "Hoc non valet, quia non sequitur: movens applicat virtutem suam ita fortiter ut moveretur et mobile non plus resistit ergo movetur, quia si hoc sit in navi mota et sit versus unam partem et currat ad alteram eque velociter, tunc alique eius partes quiescunt et tamen virtus motiva est in operatione sua sicut si moveretur", f. 34vb.

[87] A. Maier, *Zwischen*, 131-3.

[88] "Prima etiam dicit quod motus nihil est; capiendo 'aliquid' pro eo quod vere est aliquid, concedenda est, sicut dicit Aristoteles quod accidens non est ens sed est entis, etiam quia non est permanens sed successivum, et de istis dicitur 'esse' equivoce", f. 34vb.

[89] F. 34vb.

[90] See above, n.8.

[91] "Quarta, ponens quod est acquisitum, etiam est vera, quia uno modo capitur pro acquisito, sed falsa est in eo quod negat aliam acceptionem", f. 34vb.

The only difference between the third opinion and Oresme's concerns not, properly speaking, the denotation of '*motus*', but rather that of "*aliter se habere quam prius*", which he fixes in the *modus rei*, a *res pure successiva* as required by the nature of motion, and not in the *mobile*, a permanent thing, as in the third opinion (and in Ockham). The Oresmian *fluxus* is not, nevertheless, identical to Buridan's *dispositio*, a sort of accident inhering in the *mobile*. The term '*motus*' is for Oresme a *complexe significabile*, it is not a simple term, but a disguised *oratio* and as such it cannot simply denote a substantial or accidental form.

As we have seen, the existence of *modus rei*, which for Oresme is equivalent to a *fluxus* and to "*aliter se habere quam prius*", is explicitly claimed in a specific conclusion of Book III, *q*. 7; we have, moreover, seen how it is difficult to single out a successive (in the strictest acception) being in the category of substance. In the *dubia* presented by Oresme in the fifth opinion, the identification of a *fluxus* with a *res distincta* from the *mobile* is eagerly refuted. It seems, therefore, that the widening of ontology through the *modi rerum* notwithstanding, the *modus rei* is to be carefully distinguished from beings such as those included in the category of substance. The reply to the *con*-argument of this Book III, *q*. 7 hints at the different ontology of the *modus rei*: the condition (*conditio*) expressed by such a *modus* is not a "*conditio realis*" but a "*passio*" of the being.[94]

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[92] "Tertia, que dicit quod est mobile, quia ymaginatur quod aliter se habere non sit nisi res sic se habens, secundum hoc habet apparentiam, quia etiam ista conditio vel fluxus non est tale superadditum, sicut multi ymaginantur, nec est res separabilis quacumque virtute sicut est albedo", f. 34vb.

[93] See above, n. 61.

[94] "Dico quod si illa conditio sit relativa respectu extrinseci non sequitur quod propter hoc sit mutatum, sed sufficit aliquando esse mutatum; si tamen sit respectu suimet, tunc est mutatum, ut dictum est; nec dicitur talis conditio realis, ymmo passio etc.", f. 35ra. The identification between *conditio* (which is the same as '*movetur*') and *passio* could induce one to suppose that for Oresme *motus* is to be located in the category of *pati*, I think, however, that Oresme's position is very distant from the "*modus famosior*" quoted by Averroes, which is substantially favourable to a *res*-theory, see A. Maier, *Zwischen*, 62-8. In the text quoted in n. 80 Oresme states that motion is a "*mutatio preter res permanentes*".

A notable remark by Albert of Saxony in his commentary to the *Physics* III, 3, constitutes a working aid to the understanding of Oresme's position (and this remark concerns a solution to the problem of motion which actually is not far from the one put forward by Oresme):

> et ita ponentes motum non esse aliud a rebus permanentibus sed esse ipsas res permanentes taliter et taliter se habere ad invicem non concedunt: "motus est ens", quamvis bene concederent de numero eorum que sunt, sed non de numero entium.[95]

If we take seriously Albert's indication — and there is nothing in Oresme's discussion to oppose it — there are two different kinds of things to be considered as far as motion is regarded: a *res pure successiva* to be identified in the different positions (or dispositions) of *mobile* — positions (or dispositions) that exist as such, but are not *entia* —, and the *mobile* itself, a real *ens*.[96] Oresme tries on his part to grant the existence of *res pure successive*, as we have previously seen, but I do not think that his solution is far from that described by Albert. If I am right, we can conclude this paragraph by pointing out how Oresme's position is substantially inspired by Ockham's criticism of a *res*-theory, taking however into account Buridan's suggestion of considering '*motus*' a *res pure successiva*[97] or a *fluxus*, but disregarding his final *res*-theory.

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[95] "Notandum tamen quod notanter formo questionem sub hac forma: 'utrum de numero eorum que sunt alia sint permanentia etc.', non sub hac: 'utrum de numero entium quedam sint permanentia etc.', quia non de omni termino significative accepto de quo est verificabile 'esse' est verificabile 'ens'. Statim patet hoc: de nomine 'exercitus' significative accepto bene verificatur 'esse' sed non 'ens', quia quamvis hec sit vera: 'exercitus est', hec est falsa: 'exercitus est ens'", Albertus de Saxonia, *Questiones*, f. 34vb.

[96] A distinction between *ens* and *aliqualiter ens* perhaps not far removed from Albert of Saxony's is to be found in Richard Billingham's *quaestio*: "Utrum idem ⟨sit⟩ Sor et Sortem esse": "Tunc ad argumentum illud, nego illud, scilicet 'Sortem esse est igitur est aliquid', sed bene sequitur quod sit aliqualiter. Et potest concedi ulterius quod Sortem esse est ens, non tamen aliquod ens, sed aliqualiter ens", see M. J. Fitzgerald, *Richard Brinkley's Theory of Sentential Reference. "De Significato Propositionis"* from Part V of his *Summa Nova de Logica*, Leiden 1987, 135 (Studien und Texte zur Geistesgeschichte des Mittelalters, 18; I give a different punctuation, see G. Nuchelman's review of the volume in: Vivarium, 26 (1988), 153-5).

[97] A distinctive feature often required in the medieval debate on motion, see A. Maier, *Zwischen*, 89, 92, 97, 112.

8. Final remarks

Ockham regards the description of '*motus*' as "*aliter se habere quam prius*" identical with his own;[98] Buridan uses this description in order to state that '*motus*' is a *fluxus* and a *res pure successiva*. Oresme on his part is wholly original, as far as I know, in stressing the identity of this *fluxus* with the *modus seu conditio ipsius mobilis*, which allows him to avoid a *res*-theory like Buridan's and to maintain a unitary theory of motion. This effort seems, however, not to have had a large following: Albert of Saxony, even though mentioning *fluxus*, "*aliter se habere quam prius*" and so on, in his discussion of motion prefers to distinguish neatly between philosophical research (adhering on these grounds to the *mobile*-theory), and *casus divini* (accepting in this case Buridan's *res*-theory as far as local motion is concerned).

I have reported in some of the footnotes some possible sources of Oresme's doctrine of *modus se habendi*; they are however neither the only ones nor perhaps the most probable. Another possible source can be found in the discussion on the meaning of the proposition.[99] Oresme seems in fact to depart both from William Ockham and John Buridan on the meaning of "*aliter se habere quam prius*", which is the description of '*motus*' he proposes as the most probable one.[100] The ground for this departure is probably to be found exactly in Oresme's choice of a *modus rei*-theory as far as the meaning of the proposition is concerned. We have moreover seen how the difference between an *incomplexe* and a *complexe significabile* was stressed by him over and over, above all in order to avoid a *res*-theory like Buridan's. From a strictly referential point of view, the distinction quoted by Albert of Saxony permits one to gather how Oresme's (and in a different way Albert's of Saxony and Marsilius' of Inghen after him) position is more congenial to Ockham than to Buridan.

Richard Billingham is the supporter of a *modus rei*-theory as far as the meaning of the proposition is concerned;[101] it is difficult, however, to determine precisely if Oresme's direct source is Billingham.[102] I thus limit myself to pointing out a very interesting passage from the *Questiones super Artem Veterem* of Albert of Saxony, where he equates *complexe significabile* and *modus rei*:

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[98] See above, n. 8.

[99] G. Nuchelmans, *Theories of the Proposition*, 274-6.

[100] On the difference between Ockham and Buridan see M. McCord Adams, *William Ockham*, I, 305-10.

[101] J. M. Fitzgerald, *Richard Brinkley's Theory*, 3-4, 125-50 (App. I and II). The *modus rei*-theory is the first opinion recorded by Paul of Venice in the chapter *De significato propositionis* in his *Logica Magna* see Pauli Veneti *Logica Magna*. Secunda Pars. *Tractatus de veritate et falsitate propositionis et Tractatus de significato propositionis*, ed. F. Del Punta and M. McCord Adams, Oxford 1978, 80-5.

> Tertia conclusio: syncathegoremata non significant aliquam rem quae sit substantia vel accidens, sed bene significant modum rei, quod ab aliis vocatur significabile complexe. Patet hoc, nam praedicatum verificari de quolibet contento sub subiecto, vel removeri a quolibet contento sub subiecto, non est aliqua res quae sit substantia vel accidens, sed bene est modus rei et dispositio, puta subiecti vel praedicati; et sic syncathegoremata bene significant aliquid, prout ly aliquid non solum significat existentiam rei sed etiam modum rei.[103]

In the identification of *complexe significabile* with *modus rei*, the complete demarche of Oresme's discussion on motion can be summarized: beginning from Book III *q.* 1, where Oresme says that '*motus*' is a *complexe significabile*, until Book III, *q.* 7, in which the "*aliter se habere quam prius*" — that is, what results from human beings' perception of motion — is identified with the *fluxus/res pure successiva* and then with the *modus seu conditio ipsius mobilis*.

The final remark about the meaning of "*aliquid*" seems, moreover, to confirm Albert's subtle distinction between "*ens*" and "*esse de numero eorum que sunt*" in the passage quoted above[104] from his commentary on the *Physics*, or, at least, the different ontology of *modi rerum* in comparison with substances and accidents in Oresme's discussion (a difference which prevents the recourse to a *res*-theory for motion).

G. Nuchelmans' remark concerning Abelard's position on the meaning of the proposition could *mutatis mutandis* well summarize the difference between Buridan and Oresme on motion, and particularly on local motion:

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[102] Contrary to B. Hansen's conviction that Oresme is perhaps critical against "the logicians' approach to natural phenomena", B. Hansen, *Nicole Oresme and the Marvels of Nature. A Study of his "De causis mirabilium" with Critical Edition, Translation, and Commentary*, Toronto 1985 , 227 (Studies and Texts, 68), I think that he is effectively using this kind of approach here as well as in other writings, see S. Caroti, *"Peryodus" e limiti di durata nelle "Questiones super de generatione et corruptione" di Nicole Oresme*, in: P. Souffrin and A. Ph. Segonds (eds.), *Nicolas Oresme. Tradition et innovation chez un intellectuel du XIVe siècle*, Padova-Parigi 1988, 209-36; id., *Nuovi linguaggi e filosofia della natura: i limiti delle potenze attive in alcuni commenti parigini ad Aristotele*, in: S. Caroti (ed.), *Studies in Medieval Natural Philosophy*, Firenze 1989, 177-226 (Biblioteca di Nuncius. Studi e testi, 1). On this topic see J. E. Murdoch, *The Involvement of Logic in Late Medieval Natural Philosophy*, in: *Studies in Medieval Natural Philosophy*, 3-28.

[103] Albertus de Saxonia, *Quaestiones in Artem Veterem*, ed. A. Muñoz Garcia, Maracaibo 1988, 500, 767 (*Quaestiones super librum Aristotelis De interpretatione*). See also G. Nuchelmans, *Theories of the Proposition*, 241-2 and H. A. G. Braakhuis, *De 13de Eeuwse Tractaten over Syncategorematische Termen*, vol. 1, Ph.D. Leiden 1979, 488-90, n. 63.

[104] See above, note 95.

> The difference between the *res* theory which Abelard mentions and his own position may be summarized by saying that for the reists the significate of a *propositio* is a *res sic se habens*, a thing in a certain state, while for Abelard it is a *quidam rerum modus habendi se*, a certain state of things.[105]

I cannot claim that the apparent originality of Oresme's position on motion may depend, at least partially, on our inadequate acquaintance with the medieval debate on this topic: many texts are either not accessible in modern editions or not yet sufficiently explored. The importance of Oresme in the Parisian tradition from Buridan to Marsilius of Inghen — which was a constant model for the late scholastic thought all over Europe — requires nevertheless a deeper analysis of his commentary on the *Physics* and above all of the *quaestiones* where motion is discussed. In the Parisian debate, Oresme's authoritative voice fosters new perspectives which are not a mere repetition of received convictions.

Apart from the originality of Oresme's solution, I think that the importance of two elements of his discussion have to be stressed: the explicit recourse to *perspectiva* and the probable appeal to philosophical and semantic theories like those concerning relations and the meaning of the proposition. These two elements deserve attention by themselves, but they also urge us to a larger and deeper consideration of the complexity of medieval natural philosophy, a field much more interesting and complicated than what can result from an analysis only concerned with the search of precursors rather than with deepening our understanding of the historical context from where those theories originated.[106]

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[105] G. Nuchelmans, *Theories of the Proposition*, 219.

[106] The broadening of the perspectives on medieval natural philosophy in recent historiography is to be ascribed to John E. Murdoch, see S. Caroti, *Nuove prospettive della storiografia di storia della scienza medievale: le proposte di John E. Murdoch*, in: Nuncius, (1992), 231-52. See also the introductory remarks of D. C. Lindberg, *The Beginnings*, 1-4.

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Aristotelian Commentaries and Scientific Change: The Parisian Nominalists on the Cause of the Natural Motion of Inanimate Bodies

EDITH DUDLEY SYLLA

Following the lead of Pierre Duhem, historians of medieval science have long studied the work of medieval natural philosophers with an eye to seeing how it led or did not lead to the emergence of modern science in the seventeenth century.[1] If one accepts the view of Duhem and others that quite a lot of good natural philosophy was done by fourteenth-century scholastic Aristotelians such as John Buridan, Nicole Oresme, and Albert of Saxony at Paris, and Thomas Bradwardine, William Heytesbury, and Richard Swineshead at Oxford, then the question may arise why it took so long for modern science to break away from scholastic Aristotelianism to produce the new physics of the likes of Galileo, Descartes, and Newton. Edward Grant has proposed that it was, in part, the commentary form that brought it about that scholastic Aristotelians absorbed a multitude of small variations on Aristotle without overturning the whole system to replace it with something new and better.[2]

My project in this paper is to study scholastic Aristotelian commentaries on the *Physics* to see the impact of their form, and of the social and institutional context in which they were written, on their content, and on how they worked as a form of scientific practice. There are obviously too many commentaries of too great a length over far too long a period to make a global study of what was going on. The Jesuits writing commentaries at the Collegio Romano, whose works, as William Wallace has shown, influenced the young Galileo, may have had different methods and have worked in a somewhat different institutional and social context than, say, Buridan and Oresme at Paris more than two centuries earlier.[3] Here I can only do a case study, to be joined at a later date by further studies of different questions and contexts.

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[1] See John Murdoch, *Pierre Duhem and the History of Late Medieval Science and Philosophy in the Medieval West*, in: *Gli studi di filosofia medievale fra otto et novecento*, eds. R. Imbach and A. Maierù, Rome 1991, 253-302.

[2] Edward Grant, *Aristotelianism and the Longevity of the Medieval World View* in: History of Science, 16 (1978), 98. Grant suggests that the Aristotelian commentary form helped to cause the stagnation of science by atomizing it: burying new ideas in isolated contexts, never requiring a commentator to ask himself whether the answer he gave to one question was consistent with the moves he made in response to other questions. This paper began as a talk delivered at the History of Science annual meeting in Madison, Wisconsin, in November 1991 in a session honoring Edward Grant on the occasion of his sixty-fifth birthday. Part of my methodology was to examine this "Grant thesis." I want to thank Professor Grant for his commentary on this earlier occasion.

I chose to begin with a study of the related commentaries of John Buridan, Nicole Oresme, Albert of Saxony, and Marsilius of Inghen, often classed together as the Parisian nominalists, because they are often considered to be among the most outstanding fourteenth-century scientific thinkers and we have commentaries on the *Physics* by each of them. I could not, however, do a comprehensive study of all of their *Physics* commentaries, so, wanting to consider a topic that the authors themselves would have considered central, I chose a question that Nicoletto Vernia in his *Tractatus de gravibus et levibus* of ca. 1475 called the *questio physica gravissima*, namely the question of why heavy bodies naturally move down and light bodies up, a question which is typically raised in connection with Chapter 4 of Book 8 of Aristotle's *Physics*.[4]

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[3] See William A. Wallace, *Reinterpreting Galileo on the Basis of His Latin Manuscripts*, in: *Reinterpreting Galileo*, ed. William A. Wallace, Washington, D.C. 1986, 3-28 (Studies in Philosophy and the History of Philosophy, vol. 15).

[4] Anneliese Maier, *An der Grenze von Scholastik und Naturwissenschaft*, 2nd. ed., Rome 1952, 144, quoting Nicoletto Vernia, *Tractatus de gravibus et levibus*, Venice 1504: "Haec questio inter omnes physicas quaestiones gravissima est." In this paper I go over ground already ably covered by Anneliese Maier in the above work, but in addition to looking at opinions on the cause of elemental natural motion, I try to understand the scholastic Aristotelian commentary tradition as a way of doing science with certain characteristic properties. For the theoretical context within which the authors I discuss were working, Anneliese Maier provides an excellent and thorough survey, which I will not repeat here. Maier covers, for instance, 146, the distinction between *motus per se* and *motus per accidens*; between *per se* and *ab alio*; 147-48, between *potentia essentialis* and *potentia accidentalis*; and, 149, between *actus primus* and *actus secundus*. Edward Mahoney has recently made a preliminary study of Vernia's *Tractatus de gravibus et levibus*, of which he has found an edition of 1474 or 1476, making it Vernia's earliest published work. See Edward Mahoney, *Philosophy and Science in Nicoletto Vernia and Agostino Nifo*, in: *Scienza e filosofia all'Università di Padova nel Quattrocento*, ed. Antonino Poppi, Padua 1983, 137-42. The work appears together with Gaetano of Thiene, *De Coelo et Mundo*, Padua 1474?. It was later printed together with Vernia's *Contra perversam Averrois opinionem de unitate intellectus*, Venice 1505. In *Nicoletto Vernia's Annotations on John of Jandun's* De anima in: *Historia Philosophiae Medii Aevi*, eds. Burkhard Mojsisch and Olaf Pluta, Amsterdam/Philadelphia 1991, 573, Edward Mahoney identifies a copy of John of Jandun's questions on the *Physics* (Venice 1488) found in the Biblioteca Universitaria at Padua (shelfmark Sec. XV. 665) as originally

Because, unfortunately, the only known copy of Nicole Oresme's *Physics* commentary is lacking Book 8, I was not able to include Oresme in this study.[5] On the other hand, I have a fourth related author, namely the unknown author whose work was printed in Lyon in 1518 and entitled *Questiones subtillissime Johannis Marcilii Inguen super octo libros physicorum secundum nominalium viam.*[6] Taking a cue from this title, which belongs to a work closely related to that of John Buridan, Albert of Saxony, and Marsilius of Inghen, even if not authentically by Marsilius of Inghen, I am calling the group to be studied the "Parisian nominalists," without wishing to attach any particular weight to this label other than as one traditional for the group at issue.[7]

We are today in a vastly improved situation for studying the Aristotelian commentary practice of the Parisian nominalists because of recent dissertations at the Free University of Berlin by Bernd Michael and Jürgen Sarnowsky.[8] In volume 2 of his dissertation, Michael has done a magnificent job of beginning to sort out the many different versions of Buridan's commentaries on the *Physics*, as well as of his numerous other works. Moreover, in volume 1 Michael breaks new ground in discussing the nature of natural philosophical practice,

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having belonged to Vernia. I want to thank Professor Mahoney for providing me with xeroxes of the text of Vernia and for encouraging me to work on it. A study of the Parisian followers of Buridan somewhat similar to mine has been done by Stefano Caroti. See his *Da Buridano a Marsilio di Inghen: la tradizione parigina della discussione "de reactione"* in: Medioevo, 15 (1989), 173-233. Besides considering how the types of arguments used on reaction vary from Buridan to Marsilius, Caroti considers whether, and at what point, influence of English philosophers appears (specifically of Richard Swineshead's treatment of reaction) and to what extent discussion of reaction is part of the logico-calculatory tradition. Caroti uses Pietro Pomponazzi for an early backwards perspective on the issue, while I have used Nicoletto Vernia and Girolamo Pico. I was not aware of this earlier work by Caroti until after writing the earlier drafts of my own paper.

[5] A *Physics* commentary in Seville, MS Colombina 7-6-30 is currently accepted as by Nicole Oresme. See Anneliese Maier, *Die Vorläufer Galileis im 14. Jahrhundert. Studien zur Naturphilosophie der Spätscholastik*, 2nd. ed., Rome 1966, 307 ff.

[6] *Questiones subtillissime Johannis Marcilii Inguen super octo libros physicorum secundum nominalium viam*, Lyon 1518, reprint Frankfurt am Main 1964. The author is given the first name Johannes also in the explicit and table of questions.

[7] In partial justification of this label it might be noted that logical ideas do enter the discussion that I study at least with Albert of Saxony.

[8] Bernd Michael, *Johannes Buridan: Studien zu seinem Leben, seinen Werken und zur Rezeption seiner Theorien im Europa des späten Mittelalters.* Inaugural-Dissertation Ph.D. Freien Universität Berlin, Berlin 1985. Jürgen Sarnowsky, *Die aristotelisch-scholastische Theorie der Bewegung. Studien zum Kommentar Alberts von Sachsen zur Physik des Aristoteles*, Münster 1989. (Beiträge zur Geschichte der Philosophie und Theologie des Mittelalters. N.F. Bd. 32).

both at the University of Paris where Buridan himself was active and at the universities of Eastern Europe, where Buridan's works became textbooks. With regard to the *Physics*, Michael first distinguishes the various versions of Buridan's expositions of the text, in which Buridan stays quite close to an interpretation of Aristotle's meaning. With regard to questions on the *Physics*, Michael then shows without a doubt that the shortened versions (*acurtate*) were done after the long versions of the questions, most likely in Eastern European universities, and not by Buridan himself.[9] This leaves the long versions of the questions as the documents of greatest interest. Since there are long versions of the questions that call themselves the "third" and the "ultimate," it appears that Buridan may have lectured on the *Physics*, with questions, at least four times. The most important single version, then, is the *ultima lectura*, which is an *ordinatio* and is the version printed several times beginning with the edition of Paris 1509. I will return to the *tertia lectura* below.[10]

While Bernd Michael has provided the whole context for an understanding of Buridan's work, Jürgen Sarnowsky has provided a close reading of Albert of Saxony's questions on the *Physics* in particular. For Albert of Saxony, according to Sarnowsky, there may also have been two versions of at least of the first five books of his questions on the *Physics*.[11] Moreover, Sarnowsky reports that Albert, whose questions on the *Physics* were published at Paris in the edition of George Lockert in 1518, was familiar with a version of Buridan's questions on the *Physics* different from the one that appears in the 1509 printed edition, or, in other words, with the *tertia lectura* version of Buridan's *Physics* questions.[12] It is possible, indeed, according to Sarnowsky, that in the *ultima lectura* of his *Physics* questions, Buridan responded to parts of Albert's questions on the *Physics*.[13]

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[9] Bernd Michael, *Johannes Buridan*, vol. 1, 264-8.

[10] Recent studies of the various versions of Buridan's *Physics* commentaries and of their relationships to each other have also been made by J. M. M. H. Thijssen. See J. M. M. H. Thijssen, *The Short Redaction of John Buridan's Questions on the Physics and their Relation to the Questions on the Physics attributed to Marsilius of Inghen*, in: Archives d'Histoire Doctrinale et Littéraire du Moyen Age, 52 (Année 1985), 238-53 and 264; and Thijssen, *John Buridan's Tractatus de infinito. An Edition with an Introduction and Indexes*, Nijmegen 1991, xviii-xix, 46-65, and 84-92.

[11] Jürgen Sarnowsky, *De aristotelisch-scholastische Theorie der Bewegung*, 38-40, 49-51, 439-41, 451-60. See also Angel Muñoz Garcia, *Albert of Saxony, Bibliography*, in: Bulletin de Philosophie Médiévale, 32 (1990), 161-89, esp. 174-6.

[12] Sarnowsky, 50, 58.

[13] Sarnowsky, 51.

Not only is there a question of the ascription of entire works, but some manuscripts contain sets of questions on the *Physics* that combine questions elsewhere ascribed to Buridan with questions elsewhere ascribed to Albert of Saxony. Thus Cesena MS Malatestiana S. VIII.5 begins with what Bernd Michael believes to be an older version of Buridan's questions (preceding the *tertia lectura*) up through Book 7, Question 3, and then continues with questions essentially identical to those printed as Albert's questions in the Paris 1518 edition.[14] Having looked at the Erfurt manuscript SB Ampl. F 298, which is supposed to be Buridan's *tertia lectura*, I can report that, at least for the questions in Book 8 about the motion of heavy and light bodies, it is also quite close to Albert's published questions.[15]

At least two possible explanations of these similarities spring to mind. First, Albert, in composing his questions, may have been heavily dependent on Buridan's *tertia lectura* at least in the section of concern to me. If this was the case, one would expect to find a similar situation throughout the earlier questions—something I have not had the opportunity to check. Or, secondly, perhaps Buridan, in an earlier reading of the *Physics* did not finish, and either Albert finished Books 7 and 8 for him, or a copyist used Albert's independent questions to complete Buridan's work (or, third, *Albert* did not finish his reading of the *Physics*, and he or a copyist used Buridan's *tertia lectura* to fill out the unfinished parts of Albert's questions). What is a fact is that we have two manuscripts, in Cesena and Erfurt, with questions on the *Physics* both ascribed to Buridan, both different from Buridan's *ultima*

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[14] Michael, vol. 2, 568-71. J. M. M. H. Thijssen, in: *Buridan, Albert of Saxony and Oresme and a Fourteenth-Century Collection of Questions on the Physics and on De generatione et corruptione*, in: Vivarium, 24 (1986), 70-84, assigns the whole of the Cesena B. Malatest. VIII.5 *Physics* commentary to Albert. Since I currently have available only less-than-ideal microfilm prints of ff. 1r-6r and Book VIII, ff. 61-v-75v, I have not attempted to settle this difference of opinion.

[15] I would like to thank John Murdoch for allowing me to make prints of Book VIII, ff. 39v-45r, from a microfilm of this manuscript. Although there are slight differences between Erfurt SB Ampl. F 298 and the published version of Albert, all in all I would take them to be very nearly variants of the same work: they start with the same principal arguments, reach similar conclusions, raise the same objections, etc. Because I was not concerned about the issue of composite sets of questions when I made the prints, I did not check the earlier books to see if they are also the same, but the question lists, at least, appear to be different. J. M. M. H. Thijssen emphasizes that the commentary in Erfurt SB Ampl. F 298 is definitely a copy of Buridan's *tertia lectura*, whereas the commentary in Cesena B. Malatest. VIII.5 is not. Be that as it may, in the questions of concern to me the texts are structurally similar. See Appendix for parallel texts of the third principal argument to Buridan's Question 4 and replies.

lectura, and both ending up with sections either highly correlated with or essentially identical to Albert's questions. Based on my reading of the questions on my subject as compared to Buridan's *ultima lectura*, I might guess that they represent a later intellectual stage rather than an earlier one, yet on Sarnowsky's view Buridan's *ultima lectura* may have come *after* Albert of Saxony's questions. This, clearly, is a subject that requires further study.

With regard to Marsilius of Inghen the situation is also quite complicated. I have already mentioned the set of questions on the *Physics* published in 1518 at Lyon ascribed to John Marsilius Inguen. The same set of questions was published in Wadding's 1639 edition of the works of John Duns Scotus, although it was understood at the time that it was probably not Scotus's work.[16] These questions are not now considered to be by either John Duns Scotus or Marsilius of Inghen, although they seem to be intimately related to the questions of Buridan and Albert of Saxony.[17] For Marsilius of Inghen himself, then, the only known work on the *Physics* currently agreed to be by him is the *Abbreviationes*, published at Venice in 1521.[18] This work seems to be the one cited by later Eastern European authors.[19] Given Bernd Michael's discussion of the origins of shortened commentaries on Aristotle, one might ask, however, whether this is an abbreviation *by* Marsilius of someone else's questions on the *Physics* or an abbreviation *by someone else* of questions by Marsilius. If the latter case is true, one would like to find the original longer version. But in light of the incipit of the work, and in light of the questions here studied, I would suggest that it could be an abbreviation *by* Marsilius *of* Buridan's questions or those of some other Parisian nominalist.[20]

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[16] John Duns Scotus, *In VIII libros Physicorum Aristotelis Quaestiones* in *Opera Omnia*, ed. L. Wadding, vol. 2, Lyon 1634. Wadding says *inter alia*, 1-4: "Praeter stylum faciliorem, & methodum clariorem, quam quae Scoti soleat esse, doctrina ipsa discordat, & disserendi modus longe inferior est nervoso acumine Doctoris subtilis."

[17] Anneliese Maier, *Zwei Grundprobleme der Scholastischen Naturphilosophie*, 3rd. ed., Rome 1968, 277, accepts the arguments of Gerhard Ritter, *Studien zur Spätscholastik I, Marsilius von Inghen und die okkamistische Schule in Deutschland*, Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Phil.-hist. Kl., 1921 Heft 4, that there are such differences between the views expressed in the Lyon 1518 *Physics* questions and the known views of Marsilius of Inghen that the latter could not be the author of the former. She does not reject Ritter's suggestion, however, that the Lyon 1518 edition might represent a sixteenth century reworking of an earlier set of questions by Marsilius. I would like to thank J. M. M. H. Thijssen for sending me information concerning the authenticity of various works on the *Physics* ascribed to Marsilius.

[18] *Marsilii inguen Doctoris resolutissimi abbreviationes super octo libros physicorum Aristotelis*, Venice 1521. Stanisław Wielgus, Rector of the Catholic University of Lublin, is currently working on a modern edition of the *Abbreviationes*. H. A. G. Braakhuis of Nijmegen and M. Markowski of Cracow are heading an international team to provide modern editions of the most important still-unedited works by Marsilius. See Maarten J. F. M. Hoenen, *Marsilius von Inghen, Bibliographie. Appendix zu der geplanten Edition der wichtigsten Werke des Marsilius von Inghen (*† *1396)* in: Bulletin de Philosophie Médiévale, 31 (1989), 150-95. See also: H. A. G. Braakhuis and M. J. F. M. Hoenen, eds., *Marsilius of Inghen. Acts of the International Symposium organized by the Nijmegen Centre for Medieval Studies (CMS) Nijmegen, 18-20 December 1986*, Nijmegen 1992 (Artistarium, Supplementa VII).

[19] It was used, for instance, by Benedictus Hesse. See Benedictus Hesse, *Quaestiones super octo libros "Physicorum" Aristotelis*, ed. Stanisław Wielgus, Wroclaw 1984, xxxiii.

J.M.M.H. Thijssen has argued that Marsilius's *modus operandi*, as seen in his questions on the *Metaphysics* and on *De caelo*, was to take Buridan's questions (there is a ninety percent overlap in one case and a more than eighty percent overlap in the other) as a point of departure for his own solutions.[21] Recent authors have also proposed other candidates for questions by Marsilius, for instance the Cuyk manuscript, Kruisherenklooster C.12, but these remain so far only suggestions.[22] In what follows, for Marsilius of Inghen I will discuss the *Abbreviationes* as the work currently most closely associated with him, while referring to the presently unknown Parisian nominalist author of the *Questions on the Physics* of the Lyon 1518 edition as "John Marsilius Inguen."

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[20] f. 2ra: "Incipiunt subtiles doctrinaque plene abbreviationes libri Physicorum edite a prestantissimo philosopho Marsilio inguem doctore Parisiensi. Prohemium. Divina favente misericordia prima abbreviationum parte minus male quam potui scripto manifestata, restat eiusdem protectione ad secundam partem accedere, scilicet libros philosophie naturalis ac prime aliquantulum abbreviare in qua talem servabo processum: quod primo philosophiam in communi dividam et modum procedendi in scientiis ex phisicorum prohemio manifestabo. Secundo per ordinem in divisione servatum pro meo posse philosophie naturalis libros Parisius legi solitos abbreviabo." The work ends [40vb] "Expliciunt subtiles abbreviationes Excellentissimi Philosophi Marsilii Inguen in octo libros de physico auditu Aristotelis St[r]agerite emendate diligentissimeque recognite maxime a secundo libro citra per Magistrum Augustinum Montifalconium ordinis Eremitarum Sancti Augustini." I understand these statements to imply that Marsilius himself made the abbreviations, not necessarily from his own set of questions on the *Physics*, but from the *Physics* as then customarily taught at Paris. This abbreviation was later "emended" by Augustinus Montifalconius for print.

[21] Thijssen, *The Short Redaction*, 262.

[22] See J. M. M. H. Thijssen, *The Short Redaction*, 261-3, reporting the ascription by E. P. Bos, *A Note on an Unknown Manuscript Bearing upon Marsilius of Inghen's Philosophy of Nature (ms. Cuyck and St. Agatha (The Netherlands), Kruisherenklooster C 12)*, in: Vivarium, 17 (1979), 61-8. Thijssen also reports that Markowski has suggested Vienna NB MS 5437 as by Marsilius, but argues that it may be another abbreviated version of Buridan's questions on the *Physics* in the *ultima lectura.* Thijssen says that Erfurt SB Ampl. F 357, ff. 1r-95v, and Cracow BJ 743, 98 ff. contain this same work and not the long questions *secundum ultimam lecturam.*

For purposes of this paper, then, I have compared the commentaries of John Buridan, Albert of Saxony, Marsilius of Inghen, and "John Marsilius Inguen" on the *Physics*, Book 8, Chapter 4, with the idea both of seeing if I can determine their *modus operandi* and to see how the later commentaries compare to the earlier ones. Buridan has the longest treatment of the subject, followed closely by Albert of Saxony, with Marsilius of Inghen, and "John Marsilius Inguen" giving much briefer treatments.

Of his thirteen questions on Book 8 of the *Physics*, Buridan's fourth question asks whether an animal is moved by itself and from within (*a se et ex se*), but an inanimate heavy body is not (as Aristotle claimed). In his fifth question, Buridan then goes on to ask whether a body heavy in act in a high position may be moved *per se* by what[ever] may move it through removal of the impediment to its motions.[23] I will describe what Buridan does in some detail and then consider how Albert's, Marsilius's and "John Marsilius's" treatments compare.

The scholastic Aristotelian problem of the cause of natural elemental motion was preeminently a theoretical and hermeneutic problem. As far as everyday experience and common sense were concerned, it was obvious that heavy bodies fall down of themselves if they are not prevented, in the same way that the heavens rotate.[24] In Aristotelian science, however, it was not enough to know the phenomena, one also sought to know the causes of the phenomena. Moreover, Aristotle's proof of the existence of one or more prime movers (i.e. his proof that immaterial intelligences move the heavens) was taken as one of his chief achievements. In the course of proving that there are unmoved movers of the celestial spheres, Aristotle argued that inanimate bodies are not moved by themselves, whereas animals are. Elsewhere, however, he said that naturally moved bodies, by definition, have their source of motion within themselves and that it is natural for heavy bodies to move down and light bodies up. In the Venice 1562 Edition of Averroes, the question of whether heavy and light bodies move themselves is called by Marcus Antonius Zimara the seventh contradiction of Book 8 of the *Physics*.[25] The question of the cause of motion of heavy and light inanimate bodies was one, then, that had important repercussions for the rest of Aristotelian physics.

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[23] Acutissimi philosophi reverendi Magistri Johannis buridani subtilissime questiones super octo phisicorum libros Aristotelis diligenter recognite et revise a magistro Johanne dullaert de gandavo antea nunquam impresse, Paris 1509, reprinted Frankfurt a.M. 1964. f. 112va-113va: "Queritur quarto utrum animal movetur a se et ex se et non grave inanimatum." f. 113va-114vb: "Queritur quinto utrum actu grave existens sursum moveatur per se per remotionem prohibentis a quo moveatur."

[24] Cf. Nicoletto Vernia, *De gravibus et levibus*, Padua 1474?, f. 175vb: "Item Commentator...septimo *Phisicorum* commento primo dicit sensu apparet aliqua moveri ex se absque eo quod distinguatur motor a moto, sicut in quatuor elementis."

In Book 8, Question 4 (whether an animal is moved by itself and from within and an inanimate heavy body is not) Buridan first gave four principal arguments that animals do not move *ex se*, that is that they do not have the cause of their own motion within them, and two principal arguments that heavy bodies do move themselves.[26] He then distinguished four senses in which a thing might be said to move *ex se*. The fourth sense, which he said expressed Aristotle's intention, was that a thing is said to be moved *ex se* if it can be moved when immediately before it was not moved, without at that moment requiring any extrinsic mover to begin its motion, although it may have required an extrinsic mover earlier.[27] Taking to be moved *ex se* in this fourth sense, he then stated two conclusions, the first that it is possible for an animal to be moved *ex se* walking or flying or swimming, etc., and the second that in this sense heavy and light inanimate bodies do not move themselves or are not moved *ex se*.[28] Against the second of these conclusions, he made a number of objections based on special cases in which a heavy or light body might begin to move itself, for instance if it rotted through a beam or burned through a vase. Buridan responded to these objections by admitting that in rare cases heavy and light bodies can initiate their own motion.[29]

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[25] Marcus Antonius Zimara, *Solutiones Contradictionum in dictis Aristotelis et Averrois*, f. 505r. Zimara says: "Septima contradictio est in tex. 27. Aristoteles dividit motum per se in illud quod movetur ex se, id est per principium intrinsecum existens in eo, ut habentia animas, et in illud quod movetur ab alio, id est a principio extrinseco, ut sunt inanimata...ubi patet de intentione Aristotelis et Commentatoris fuisse gravia et levia moveri ab extrinseco. Cuius tamen oppositum scribit Commentator in infinitis locis... Dicimus nos istam fuisse Aristotelis indubitatam sententiam qui, in quaestionibus arduis et difficilibus, ut inquit Themistius in 1 *de anima*, loquitur secundum proprietatem sermonis et non per metaphoras. In hoc enim ipse in plerisque redarguit Platonem. Dico igitur quod proprie illud dicitur motum per se ex se quod apparet moveri ab aliquo principio intrinseco, nullo motore extrinseco sensibiliter movente et sensibiliter concurrente ad talem motum. Hoc autem est animalibus proprium... et hoc proprie apud Graecos dicitur motum ex se per se. Tale autem non videmus accidere in aliquo inanimatorum sed semper videmus quod aliquod exteriorum movet ipsa."

[26] For the third principal argument that animals do not move themselves, see Appendix.

[27] Buridan, f. 112v: "Quarto modo qui in proposito est ad intentionem Philosophi aliquid dicitur moveri ex se quia potest moveri cum immediate ante non moveretur absque hoc quod incipiendo motum suum indigeat movente extrinseco, licet ante bene indiguit movente extrinseco."

[28] f. 113r: "Prima est quod possibile est animal moveri ex se localiter ambulando vel volando vel natando aut huiusmodi. Constat quod cum homo dormit vel sedet ipse quiescit quiete opposita ambulationi vel motui...et tamen postea videmus ipsum ambulare, nec ad hoc requireretur motor extrinsecus. Immo causa in sic incipiendo

In his fifth question, then (whether something heavy in act in a high place may be moved *per se* by what[ever] may move it through the removal of the impediment to its motion), Buridan began with seven principal arguments mostly from authority why a heavy body is not moved by itself *per se* after it is generated and after the removal of what prohibits it from falling.[30] For the other side he then argued that since

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motum post talem quietem potest esse quia fumi facientes sompnum digeruntur per calorem intrinsecum...et tunc species sensibiles reservate in fantasia vel memoria possunt movere sensum communem ad actum cognoscendi et sequitur actus appetendi aliqua extrinseca et tunc ab huiusmodi sensu et appetitu movetur animal...et hec omnia sic moventia animal erat intrinseca vel intra ipsum... Secunda conclusio est quod isto modo grave vel leve inanimatum non movet se vel etiam non movetur ex se. Nunquam enim incipit moveri cum ante non moveretur quin currant commovens [*sic, but better* concurrat movens] extrinsecum, scilicet vel generans gravitatem aut levitatem vel removens prohibens."

[29] f. 113r: "Deinde etiam arguitur contra secundam conclusionem fortissime per plures et diversos casus possibiles. [1] Primus casus ponitur si super trabem ponatur onus grave, tandem sine alio motore extrinseco illud onus franget trabem minus debilem existentem et ex se removebit prohibens et cadet deorsum cum prius quiesceret sursum... quia possibile est quod illud gravemet est alterativum trabis et putrefactivum et combustivum et sic trabis virtute debilitata tandem grave illud franget trabem et cadet cum ante quiesceret. Ita etiam si sit exhalatio ignea reclusa sub vase adustibili ut non possit ascendere, ipsa sic tandem poterat urere illud vas quod perforabitur illud vas et ascendet illa exhalatio. Et ita illa exhalatio levis removebit suum prohibens sine motore extrinseco et ita de facto vivum argentum positum in vase stagneo vel plumbeo sic aget in vas quod tandem perforabit ipsum et cadet. Et hoc modo sunt alii casus multi consimiles in quibus grave vel leve per virtutem suam et sibi intrinsecam potest movere prohibens sine alio motore extrinseco... Et ita videtur quod ista secunda conclusio non sit universaliter vera sed sic potest modificari quod raro et in paucioribus contingit quod grave et leve inanimatum post eius quietem incipiat movere se sine presentia et concursu motoris extrinseci, sed sepe et in multis animal movet et potest movere se de loco ad locum sine indigentia motoris extrinseci concurrentis ad incipiendum motum." A similar counter example about a heavy body breaking a beam supporting it is mentioned by John Duns Scotus, *Ordinatio*, in *Opera Omnia*, ed. P. Carolo Balić et al., vol. VII, Vatican 1973, 361-2.

[30] In Question 4, a body is said to move *ex se* if it has the source of its motion within itself rather than externally. So *ex se* is the opposite of *ab alio*. Here Buridan has additionally in mind earlier arguments that heavy bodies move themselves *per accidens* in natural motion in the sense that they move the medium, which in turn causes them to move: their motion, then, is not what is primarily intended. In this sense, then, *per se* is the opposite of *per accidens*, and it is an additional characteristic beyond moving *ex se*.

these bodies are moved naturally they must be moved by their nature or substance.[31] By way of reply, he began by proving that when what prohibits the motion has been removed, the heavy body's motion cannot be continued by the generator, by the remover of the impediment, by the natural place, by the heavens, or by the medium. By process of elimination, then, it remained that the heavy body must be moved down by its heaviness.[32] Finally, he determined the senses in which this motion could be said to be *per se*: the motion may be *per se* in the sense of being in accordance with the body's nature, but it is not *per se* in the sense that nothing but the heavy body is involved.[33]

Overall, Buridan's approach to and solution of these questions is surprising, because he stated in reply to the fourth question that in one sense, albeit not the sense Aristotle intended, heavy bodies in natural motion do move themselves just as the heavenly spheres move themselves and animals move themselves.[34] In each case, there is an internal distinction between mover and moved, as Aristotle had argued must be the case. Taking the heavens as the combination of the spheres and the intelligences, Buridan said that the intelligences move the spheres, the souls move the bodies of animals, and the forms of heavy bodies move their matter. He did not respond to the third principal argument in the fourth question that in both animals and elements there is nothing moved in act, since in elements there is nothing but substantial form and prime matter, and, if the soul is the only substantial form of an animal, it is also the case in animals that there is nothing in act to be moved—he did not respond because, in his reply to the question, he as much as admitted that there is a mover and something moved in heavy and light bodies as in animals.[35] Thus, in this part of his solution to the problem, Buridan seems to have given up an essential claim of Aristotelian physics—at least as understood by previous commentators—without thoroughly arguing his case.

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[31] f. 113v: "Oppositum arguitur quia illud grave movetur naturaliter, igitur per suam naturam. Et natura rei est de eius substantia; est enim materia vel forma eius ut patet secundo huius. Igitur movetur per suam substantiam et hoc est moveri per se."

[32] f. 114r: "Ultima conclusio est quod grave sic movetur deorsum a sua gravitate immediate et leve sursum a sua levitate, quia predictis conclusionibus negativis concessis non apparet aliud restare a quo debeamus dicere quod grave vel leve moveatur active et proprie."

[33] f. 114r-v: "Uno modo dicimus aliquid convenire alicui per se quia convenit sibi per suam naturam vel dispositionem nature sue convenientem... Et isto modo diceremus grave moveri per se deorsum, quia per suam naturam [*correxi ex* materiam] et quia etiam ille motus et locus qui per illum motum acquiritur est conveniens sue forme, que est natura eius... Secundo modo per se significat idem quod solitarie... Et secundum istam locutionem posset dici quod grave movet se per se quia licet in incipiendo motum concurrat bene movens extrinsecum, tamen post non oportet quod concurrat movens extrinsecum. Et sic solum grave movet, non sic solum quin gravitas moveat que tamen est alia ab ipso gravi, sed sic solum quia non concurrit movens extrinsecum. Sed non per se, scilicet solitarie, movetur quod indiget quod etiam aliud extrinsecum moveatur, scilicet medium, quia dividitur quod resistit."

[34] This is according to the third sense in which to be moved *ex se* may be taken. f. 112v: "Tertio modo potest intelligi quod aliquid moveatur a se et ex se quia componitur ex motore et moto et partibus quarum una movet aliam, et sic dico ut prius quod celum pro congregato, etc. movetur ex se et etiam animal, quia anima movet corpus, et etiam grave inanimatum, quia forma movet materiam..."

Ernest Moody, in the preface to his edition of Buridan's *On the Heavens*, describes Buridan's style as "diffuse, leisurely, and personal in tone," and he says that Buridan:

> appears to have followed no particular authority or scholastic sect, and to have utilized the ideas and arguments of his predecessors and contemporaries for the philosophic end of the discovery and statement of the truth concerning the things which are, to the extent that human reason and experience afford the method and the materials for this enterprise.[36]

This characterization might also be applied to Buridan's questions on the *Physics*. In the questions under consideration, Buridan seems not to have been under much stress to defend himself against opposing views, as is exemplified by the fact that he did not deal with the issue of prime matter not being a suitable entity to be moved. The only previous commentator he identified in the two questions under consideration is Averroes, called "Commentator."[37] Although Buridan's position was different from that of Aristotle and Averroes on this point, he did not self-consciously try to differentiate his position from that of anyone else. Having stated what he said were Aristotle's conclusions, Buridan went on to recite other differences between the motion of animals and the elements as they had been mentioned by

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[35] See Appendix.

[36] *Iohannis Buridani Quaestiones super Libris Quattuor de Caelo et Mundo*, ed. Ernest Moody, Cambridge, MA 1942, reprint New York 1970, xiv.

[37] See e.g. f. 112v: "Forma enim est motor et materia est mota ut dicit Commentator quarto huius et hoc manifestum est etiam per hoc quia ipsum movetur a principio intrinseco quia forma vel etiam gravitas est intrinseca ipsi gravi. Et oportet etiam si non moveretur a principio intrinseco non moveretur naturaliter sed violenter. Ergo movetur ex se. Item in tertio *Celi* dicit Commentator quod lapis movet se inquantum est actu gravis et movetur secundum quod est in potentia deorsum. Etiam in quarto *Celi* dicit quod in gravi minus distinguntur motor et motum quam in animali. Ergo eque vel magis lapis movetur ex se quam animal."

Aristotle—for instance that animals can move with contrary motions and rest of their own accord in opposing positions, whereas elements cannot. An animal, said Buridan, can move from home to church and back again, whereas a heavy body only moves downward. Buridan finished the determination of Question 4 by saying, "These are the conclusions and their expositions posited here by Aristotle."[38]

Against Buridan's first two conclusions in question 5, that neither the generator nor the remover of the impediment can be the cause of the continued downward motion, it was objected that it is manifestly opposed to Aristotle's conclusions that heavy and light bodies are not moved by themselves but by their generator or the remover of the impediment to their motion.[39] Buridan replied to this that according to Averroes, when the generator gives the body a form it gives it everything that follows from that form, so that the generator will act in this indirect sense. Perhaps Aristotle's intent was not that the generator continues to act during the natural motion, he went on, but only that it gives the body its motive power, namely its form and heaviness.[40]

Having reached the conclusion that heavy and light bodies are moved by their heaviness and lightness, Buridan raised the possibility that instead these bodies might be moved by their substantial forms, but, he said, this appears not to be the case, since the Eucharist, without any substantial form, continues to fall down as before and likewise water vapor rises despite having the substantial form of water. He recommended that the reader look at his fifth question on Book 2 of the *Physics* for a fuller treatment of this issue, where he speculated that in some cases the substantial form acts and in others the accidental form of heaviness or lightness acts.[41]

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[38] f. 113r: "Item quod sic movetur ex se potest sic movere se motibus contrariis successive. Sic autem animal movet se ut de domo ad ecclesiam et post revertendo de ecclesia ad domum. Sic autem grave inanimatum non movet se... Iste sunt conclusiones et earum declarationes posite hic ab Aristotele."

[39] f. 114r: "Sed tu dices quod iste conclusiones sunt manifeste contra Aristotelem qui dicit sic quod gravia et levia non a seipsis moventur sed aut a generante et faciente grave et leve aut ab impedientia et prohibentia solvente."

[40] f. 114r: "Et Commentator super hoc dicit quod generans dans formam dat omnia consequentia formam quorum unus est motus localis. Item solutio dictum est secundo huius quod aliquid dicitur respectu alicuius agens improprie secundum multos diversos modos attributionum. Generans igitur dicitur movere ipsum grave ad istam intentionem non quod amplius agat aliquid in ipsum grave quando grave movetur, sed quia egit ipsi gravi dando motivum, scilicet formam vel gravitatem, a qua sic movetur etiam forte generante corrupto. Similiter ad talem sensum dicitur moveri a removente prohibens..."

Elaborating on the conclusion that heavy and light bodies are moved by their heaviness and lightness, Buridan went on in Book 8 Question 5 to say that although a heavy body does need an extrinsic cause to start its motion (either the generator or the remover of the impediment), nevertheless after the start it is the heaviness that moves the body. Aristotle and the Commentator, in saying that heavy bodies do not move themselves, probably had in mind, he said, the fact that a heavy body does not *take time* to move down unless a medium resists, and indeed in this way animals are different from elements because animals have an intrinsic resistance and so do not need an external medium to move over a period of time. Thus although a heavy body does not need an external mov*er* to continue its motion downward, it does need an external mov*ed* body, namely the medium.[42]

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[41] f. 114r: "Si enim aliquis diceret quod movetur a sua forma substantiali, apparet quod non, vel tamen magis apparet moveri sic a sua gravitate vel levitate. Unde in sacramento altaris non manet aliqua forma substantialis in hostia que ante esset in ea et tamen quia manet gravitas caderet deorsum sicut ante. Et forte quia vapor elevatus ab aqua est adhuc substantialiter aqua et tamen quia factus est levis movetur sursum et non ad locum naturalem aque, ideo sic non movetur per formam substantialem aque sed levitatem. Tamen quid de hoc ultra sit dicendum recurrendum est ad quintam questionem secundi libri." In Book 2, he said that substantial forms are the principles of action for effects agreeing with their nature, but they may not be the principal cause if the effect is foreign to them. In this case the substantial form would be the principal cause of the fall of water, but not of its rise in the form of water vapor. In the case of the Eucharist, Buridan intimated that since the accidental form in itself may not be sufficient to produce the observed effect, God may act miraculously along with the accidental form to supply the actions that the substantial form would otherwise have caused. Book 2, Question 5, ff. 32r-33v, mislabelled xxii and xxiii: "si terra existens sursum descendit naturaliter deorsum utrum substantia terre movet se active vel gravitas ... videtur michi dicendum primo quod forma substantialis non est principium per se activum ad mutationes et quietes sibi disconvenientes, quia potius resisteret et inclinaret ad oppositum... Sed dicendum est quod forma substantialis est principium activum ad mutationes sibi convenientes... His visis concludendum est tertio quod forme substantiales sunt principia principaliter activa ad mutationes et quietes sibi convenientes et non accidentia eis coniuncta... Ad tertiam credo esse dicendum quod movens active vaporem sursum si sit agens extrinsecum non est nisi levitas et forte caliditas ad quam consequitur levitas, et forma substantialis aque magis est resistens et corrumpens tam caliditatem quam levitatem et reducens se ad statum sibi convenientem... Ad sextam potest concedi quod accidentia bene moverent licet essent sine forma substantiali et quod cum eis non oporteret ad movendum concurrere principaliter aliud principale agens sive movens quam Deum...et cum hoc potest dici quod in talibus miraculosis Deus etiam miraculose supplet actiones que essent a forma substantiali si illa esset sub illis accidentibus." The sixth principal argument, to which this last passage is an answer, was: "Item magnum argumentum ad propositum est ex eo quod fide credimus de sacramento altaris videlicet quod ibi accidentia nobis apparentia non habent substantiam sibi subiectam et tamen ita agunt et movent sicut si haberent, scilicet gravitas movendo deorsum, calor et sapor movendo sensum, vel frigiditas calefaciendo vel frigefaciendo tanquam substantia subiecta nichil ad illos motus conferat sed quod ille caliditates faciunt hec omnia."

In sum, taking Buridan's treatment of this question in isolation, he seems to be pursuing physical truth about the cause of the natural motion of the elements—and to be bringing in particular cases such as a weight breaking a beam to move down or fire burning through a vase to move up—, while at the same time he interprets Aristotle's text so that Aristotle's intent is understandable and not opposed to his own conclusions, initial impressions to the contrary notwithstanding. Aristotle said that the elements do not move themselves in natural motion. Buridan says they sometimes do move themselves even to the extent of starting their own motion, but they can only move in one direction and they need an external resistance if they are to move in time: whatever Aristotle said, Buridan implies, was not fundamentally opposed to such conclusions.

If I turn now to Albert of Saxony's treatment of the same issue to see if it fits with my initial interpretation of Buridan's position, two aspects of Albert's treatment are immediately noteworthy. First of all, Albert's treatment is very closely related to Buridan's, although Albert reorganized the material somewhat by dividing Buridan's first question into two, first asking whether animals are moved by themselves and then in a second question asking whether heavy and light bodies are moved by themselves. With regard to the motion of animals, Albert's four principal arguments are the same as Buridan's four principal arguments on the same issue and arranged in the same order, including the same objection and reply to the third principal argument concerning the impossibility of dividing an animal into a mover in act and a moved thing in act.[43] Overall, Albert's treatment of the issue is perhaps twenty percent shorter than Buridan's and it is more logically organized.

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[42] f. 114v: "Et secundum istam locutionem posset dici quod grave movet se per se quia licet in incipiendo motum concurrat bene movens extrinsecum, tamen post non oportet quod concurrat movens extrinsecum, et sic solum grave movet: non sic solum quin gravitas moveat que tamen est alia ab ipso gravi, sed sic solum quia non concurrit movens extrinsecum. Sed non per se, scilicet solitarie, movetur quod [*sic, but better* quin] indiget quod etiam aliud extrinsecum moveatur, scilicet medium, quia dividitur quod resistit. Unde videtur esse intentio Aristotelis et Commentatoris in quarto huius quod nisi medium resisteret non esset motus sed mutatio instantanea. Sic autem animal posset moveri per se a seipso, quia ex seipso habet resistentiam movendi. Sed verum est quod de facto semper animal movetur per medium quod dividitur nisi illud medium moveatur cum eo quia cum non possit naturaliter esse vacuum, animal semper habet undique corpus sibi contiguum quod oportet moto animali dividi si non moveatur cum animali. Aliter esset penetratio corporum. Sed tamen sic est differentia quantum ad hoc inter animal et grave inanimatum, quia grave inanimatum non habet ex se resistentiam prout videtur velle Aristoteles et Commentator quarto huius. Ideo si medium extrinsecum non resisteret non esset motus neque successio. Sed animal ex corpore suo habet resistentiam anime moventi, ideo esset motus et successio temporalis quamvis medium extrinsecum nullius esset resistentie. Et videtur michi quod istam differentiam voluit nobis Aristoteles notare in illa ultima ratione quam posuit ad probandum quod grave inanimatum non movetur ex se, sed animal bene, scilicet quia si debeat esse motus cum resistentia, necesse est, si aliquid moveatur ex se scilicet sine indigentia motoris extrinseci et moti extrinsici, quod ipsum sit divisibile in partem per se moventem et partem per se motam, intelligendo per partem per se motam illam que ex se habeat resistentiam motori. Sic enim bene divisibile est animal, sed non grave inanimatum."

Comparing the printed versions of the two texts, it does not appear that Albert had Buridan's text before him as he wrote and copied from it, but, judged by content, both men are clearly working within the same intellectual context. Here, however, I must take note of Jürgen Sarnowsky's assertion that Albert was working from Buridan's *tertia lectura* and of my observation that the relevant questions in the copy of Buridan's *tertia lectura* found in Erfurt SB MS Ampl. F 298 have essentially the same structure as the printed version of Albert's commentary.[44]

Keeping the ambiguous status of these questions in mind, let me point out several of their interesting aspects, continuing to assume, at least for the time being, that the author is Albert of Saxony. First of all Albert said clearly in introducing his determination of the first question that:

> This question is not raised for any other reason except so that it might be seen how Aristotle's statement that animals are moved by themselves but inanimate heavy bodies are not is to be understood, since in both cases the body is moved by its form inhering in it and intrinsic to it.[45]

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[43] For the third principal argument and reply, see Appendix.

[44] I have put together a comparison of the two works and of Cesena, Malatest. S.VIII.5, showing how, albeit with variants, they parallel each other from argument to argument, conclusion to conclusion, and objection to objection, but I do not have space to include it here. I have, however, included in the Appendix parallel texts for the third principal argument to Buridan's Question 4 and replies to it.

[45] Albert of Saxony, *Questiones eximii Doctoris Magistri Alberti de Saxonia in octo libros physicorum Aristotelis*, in: *Questiones et decisiones physicales insignium virorum...recognitae rursus et emendatae summa accuratione et iudicio Magistri Georgii Lokert Scoti*, Paris 1518, f. 79v: "Ista questio non est mota propter aliud nisi ut videatur quomodo debeat

Like Buridan's *ultima lectura*, Albert's solution was that the difference between the two cases is that heavy bodies must have immediate initiators of their motion (the generator or the remover of the impediment), whereas animals can initiate new movement on the basis of images stored in memory. While Buridan's *ultima lectura* gave a complex answer concerning the respective roles of the substantial form and of the heaviness and lightness in causing these motions, Albert took the simpler position, which he said was common, that the heavy body is moved principally by the substantial form but instrumentally by the heaviness.[46] Albert made more explicit than Buridan's *ultima lectura*, moreover, the potential problem with this solution if, in both animate and inanimate bodies, the mover is the substantial form and what is moved is only prime matter, not a suitable candidate for a moved thing in the Aristotelian system. In Albert's version, the third principal argument that an animal is not moved by itself states that:

> Third, according to Aristotle in this eighth book every moved thing is divisible in a *per se* mover and in a part *per se* moved, but this is not the case in animals, therefore animals are not moved by themselves. Proof of the antecedent: an animal is divisible into a body and a soul, but the body without the soul is not moved by itself because whatever is to be moved by itself ought to be an entity in act through some form, but without the soul, it appears that the body is not in act by any form. And if it is said that although, without the soul, it is not in act by any substantial form, nevertheless it is in act by some accidental form and this suffices, [I say] no, if this sufficed then an inanimate heavy body would be or could be said to be moved by itself, which Aristotle denies in this eighth book. The inference is proved by the fact that an inanimate heavy body is divisible into a part moving by itself, namely its form, and into another part that is moved, which is still, without the form moving by itself, in act by some accidental form.[47]

In reply to this principal argument, Albert denied the minor, i.e. that an animal is not divisible into mover and moved, and asserted that in fact an animal is divisible into a part *per se* moving and a part *per se* moved, denying that, without the soul, the body is not in act. On the contrary, he said, it suffices that it is an entity in act that resists the motor, which is the case for animals. For inanimate heavy bodies,

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intelligi dictum Aristotelis, scilicet quod animal movetur ex se et grave inanimatum non, cum tamen utrumque eorum moveatur per suam formam sibi inherentem et intrinsecam."

[46] f. 80v: "Quinta conclusio: secundum quod communiter tenetur grave movetur naturaliter a sua forma substantiali principaliter et a sua gravitate instrumentaliter."

[47] See Appendix.

on the other hand, when the substantial form is taken away, what is left remains in act by heaviness, but this heaviness does not resist the mover, namely the substantial form of the heavy body. This is why an animal is said to be moved from within, while an inanimate heavy body is not.[48] It may be noted that in this reply Albert accepted that a heavy body without its substantial form remains in act by its heaviness and is not simply prime matter, though it does not resist the mover.

In order to sort out the relation of Albert's commentary to Buridan's *tertia lectura*, it will be useful to see what the version in Erfurt SB Ampl. F 298 contains concerning this third principal argument on the self-motion of animals and the reply. The principal argument itself is very similar to that found in both Buridan's *ultima lectura* and Albert's printed questions.[49] The reply parallels that of Albert's printed questions, with however the apparent difference that where Albert admits that an inanimate heavy body minus its form is still in act, although it does not resist, the commentary of Erfurt Ampl. F 298 says that the remainder is not in act in the sense that the act resists the mover.[50] Perhaps this is a difference only in words and not in opinion.

Thus, comparing Albert's treatment of the question to Buridan's *tertia lectura* and *ultima lectura*, we see that they all come to the same conclusion, but while Buridan's *tertia lectura* says in so many words that a heavy body without its heaviness is not in act in the sense of resisting, and Buridan's *ultima lectura* dispensed with replying to the principal arguments altogether, Albert in addressing the issue raised by the third principal argument claims that a heavy body without its substantial form is still in act, though it does not resist. On this small issue, then, Albert's commentary seems to represent "progress" beyond the *tertia lectura* that is not reflected in the *ultima lectura*. Alternately, one could judge that Albert's reply is better than that of the *tertia lectura*, but say that the *ultima lectura* represents a stage in which an earlier controversy about whether an animal's body without the soul is in act has died down, so that a nuanced answer was no longer required. The rest of Albert's treatment could be seen as a tidied up version of Buridan's *ultima lectura*, but, in light of our brief comparison to the *tertia lectura*, we should perhaps admit that this brief comparison is insufficient to decide whether Albert's work came before or after the *ultima lectura*.[51]

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[48] See Appendix.

[49] See Appendix. I also include the parallel text in the Cesena manuscript for comparison.

[50] See Appendix for parallel texts in Erfurt, Amplon. F 298 and Cesena Malatest. S.VIII.5.

It is notable that when Albert came to discuss the motion of heavy bodies in particular, he did not say that they are divided into forms as movers and matter as moved, but, in his second principal argument, called what is moved "the rest" of what is moved.[52] Contrary to the usual scholastic form, he answered his sixth question (whether heavy and light bodies may be moved of themselves) in agreement with the principal arguments, rather than with the opposition based on Aristotle's claim in Book 8 that it is impossible that inanimate heavy and light bodies move themselves.[53] When he came to the end of the question, then, it was not necessary to answer the principal arguments, since they agreed with the conclusion, but he said that the principal arguments may go to the street of Saint James, i.e. to the Dominicans.[54] This would support the hypothesis that the Parisian nominalists by this time—perhaps in contrast to the Dominicans—were no longer themselves particularly concerned with the status of a body taken in separation from its substantial form.

In his *Abbreviationes*, Marsilius of Inghen essentially followed Buridan—in fact, as I indicated above, one might suppose that Marsilius's work is an abbreviation of Buridan's *ultima lectura*, at least for these questions. Having made many of the same arguments and distinctions, Marsilius concluded that elements can move themselves in the sense that they have a part that acts as mover and a part that acts as what is moved. While in most cases the generator or the remover of the impediments to motion is necessary to start the element's natural motion, in unusual cases, as when mercury eats through its container, inanimate bodies may start their own motion.[55] Once the motion is started, the substantial form is the principal cause of motion, and the heaviness or lightness is the instrumental cause.[56] Considerably shorter than the two previous works, the most notable characteristic of Marsilius's *Abbreviationes* is how closely it follows the moves of Buridan.

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[51] If Buridan had Albert's questions when he wrote the ordinatio of the *ultima lectura*, the question is why he did not adopt Albert's wording of the solution. He says in question five that the remainder of a heavy body does not resist its heaviness, but he does not address the issue in so many words whether or how it is in act.

[52] Thus his second principal argument that heavy and light bodies can move themselves is, f. 80r: "Secundo: illud movetur quod dividitur in partem per se moventem et in partem per se motam, et sic est de gravi et similiter de levi. Dividitur enim in formam per se moventem et in residuum per se motum."

[53] f. 80r: "In oppositum determinat Aristoteles in isto octavo dicens gravia et levia inanimata moveri ex seipsis est impossibile."

[54] He says, f. 80v: "Rationes vadant ad vicum vatum [*sic, but better* votum] ad sanctum Jacobum." The convent of the Dominicans was located on Rue Saint-Jacques. The Dominicans were called "Jacobins," or associated with Saint James, because a chapel dedicated to Saint James was given to them when they first moved to Paris. See Astrik L. Gabriel, *Student Life in Ave Maria College, Mediaeval Paris. History and Chartulary of the College*, Notre Dame, IN 1955, 206, n. 13. MS. Cesena, Malatest. S.VIII.5, f. 69v, says only "Rationes principales vadunt viis suis."

"John Marsilius Inguen," whoever he was, limited himself to one question on this issue, namely to the question whether heavy and light things may be moved by themselves. He made the same distinctions and came to the same conclusions as Buridan, Albert, and Marsilius, albeit in much abbreviated form. Both Buridan and Albert had concluded, with Aristotle, that if the elements, or the heavens, or animals are said to move themselves, it is because some part in the thing moves some other part and never because the whole moves and is moved. Buridan had concluded, however, that the form of the heavy body, and a soul, and an angel do move themselves as wholes. "John Marsilius Inguen," to the contrary, concluded with Aristotle that a whole can never move itself as a whole. Among other arguments, he argued "a posteriori" that this must be true because, if it were the case that something could move itself as a whole, then there would be no way to prove the existence of separate substances, that is, of Aristotle's unmoved movers.[57] While Albert had in several cases omitted Buridan's references to analogous cases of the causes of heavenly motion, "John Marsilius Inguen" included them, and like Buridan, he dealt with the unusual cases in which a heavy or light body might initiate its own motion, for instance by breaking or burning what was prohibiting its motion.[58]

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[55] *Marsilii Inguen Doctoris resolutissimi abbreviationes super octo libros physicorum Aristotelis*, etc. f. 36va: "[in marg: Utrum animal movet ex se et non grave inanimatum] Quantum ad secundum est primo notandum quod aliquid moveri a se vel ex se potest intelligi quadrupliciter...

Tertio quod sic movetur a principio intrinseco, scilicet quod componatur ex duobus partibus quarum una movet et alia movetur.

Et quarto ad propositum dicitur aliquid movere seipsum vel a se quia ad hoc quod incipiat se movere post eius quietem non indiget motore particulari extrinseco concurrente quamvis ante indigeat...

Tertia propositio. Tertio modo tam animal quam grave simplex movetur a seipso. Patet, quia a sua forma movente movetur et per modum sequele ad motum materie.

Quarta propositio que erat de intentione Philosophi. Prout in pluribus animal potest moveri a seipso quarto modo, et grave simplex non, nisi in paucioribus. Prima pars patet, quia ut in pluribus animal post eius quietem ut post somnum potest movere seipsum. Secunda pars patet, quia si grave simplex quiescat naturaliter, tunc nunquam movet seipsum, cum eius motus a loco naturali esset ei violentus. Si autem quiescat violente, vel igitur est actu grave, et si sic, tunc quiescit sursum propter impedimentum. Aliter actu grave non quiesceret violente, et per consequens ut in pluribus ad hoc quod moveatur indiget movente particulari extrinseco removente prohibens. Vel est leve, sicut vapor elevatus, et si sic, tunc tale ut in pluribus indiget generante gravitatem. Et additur in conclusione "ut in pluribus" eo quod non est inconveniens grave vel leve quandoque per suam naturam propriam removere prohibens, ut argentum vivum in piscide lignea potest perforare piscidem et descendere. Similiter potest quandoque seipsum reducere ad gravitatem ut vapor si removeatur a calefacientibus. Supposito quod non concurrat particulare generans gravitatem aliud ab eo, non minus se reduceret ad gravitatem. Hic est unus modus respondendi."

[56] f. 36vb: "Sexta propositio. Grave sic motum deorsum naturaliter movetur immediate a sua gravitate tanquam instrumento et sua forma substantiali tanquam principaliter agente. Patet quia non videtur unde alias moveretur. Modi enim alii quibus imaginari posset ipsum moveri sunt amoti."

Thus all four fourteenth-century commentators defended Aristotle's words or imputed intentions, while taking a position in favor of a heavy body's *per se* continuation of its own motion that went beyond what Aristotle had said. Aristotle, by picking apart the meanings of "heavy" and "light" and by claiming that the very words included the conception of motion to and subsequent rest in the natural place, attempted to downplay any efficient causation that remained after a heavy or light body was generated and anything preventing its motion removed. Buridan and his followers, on the contrary, took the position that the motion to the natural place *does* need an additional explanation, and they chose an intrinsic form of the body as that cause. What may be surprising, when their works are looked at in isolation, is that they did not acknowledge to a greater extent their deviation from Aristotle, Averroes, and the earlier Latin writers. Albert of Saxony says merely that the apparently opposing authorities of Aristotle and the Commentator are to be "glossed" so that they are not in disagreement.[59]

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[57] *Questiones subtillissime Johannis Marcilii Inguen super octo libros physicorum secundum nominalium viam*, Lyon 1518, f. 83r: "Quantum ad primum modum [quod secundum se totum et quamlibet partem sui est movens et motum ita quod non est aliqua pars sui quantitativa vel essentialis que moveat quin moveatur, nec aliqua mota quin moveatur] est ista prima conclusio, quod impossibile est aliquid moveri a se. Probatur, quia si aliquid moveretur a se predicto modo, sequeretur quod ipsum omnino secundum idem sui esset in actu et in potentia... Quarto probatur a posteriori quia si aliquid posset sic moveri a se, tunc per nullam viam possemus probare aliquas esse substantias separatas, quod est falsum ut patet in isto octavo et in duodecimo *Metaphysice.*"

[58] ff. 83r-v: "Quinto probatur in isto octavo inductive, quia celum ratione intelligentie movet et ratione orbis movetur et sic secundum diversa movet et movetur. Item animal movetur secundum materiam et movet secundum formam et eodem modo de gravi et levi. ...omne mobile componitur ex movente et moto ut patet inductive quia celum componitur ex intelligentia et orbe, et animal ex corpore et anima, mixta inanimata et elementa componuntur ex materia et forma, et sic cum quodlibet mobile componatur ex movente et moto, sequitur quod quodlibet mobile movetur a se isto modo. Tertia conclusio est de tertio modo: quod nihil movetur a se tertio modo nisi celum...

What is going on here? In my judgment, it is impossible to answer this question reliably without looking more widely at other parts of these commentaries, at earlier or later commentaries on the same passages or on other Aristotelian works, or at other sorts of contemporary works in natural philosophy, theology, or logic. Whether or not Edward Grant is right that the commentary form atomizes later medieval natural philosophy, my "case study" method has not worked in the most obvious sense of allowing clear conclusions to emerge from study of related commentaries on a single passage. In what follows, then, I begin to look more broadly for evidence that would allow greater certainty in interpreting my chosen passages from four commentators.

One possibility, of course, is that Buridan and his followers did not emphasize their deviation from Aristotelian paths because they were not original in this deviation. In fact, according to Anneliese Maier's

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Secundo arguitur quod grave movetur ex se quia si aliquod grave ponatur supra trabem, possibile est quod ibidem quiescat et postea frangat trabem et moveatur deorsum. Igitur tunc grave ex se movetur sine presentia motoris extrinseci, quia illud impedimentum non removetur a motore extrinseco, sed a seipso.

Tertio arguitur de levi: posito quod ignis ponatur in aliquo vase faciliter combustibili, tunc ignis quiescit violenter quod prohibitur ab illo vase. Sed non requiritur motor extrinsecus ad removendum prohibens, quia ignis de se potest comburere vas per quod prohibetur. Igitur ignis movetur ex se sine presentia motoris extrinseci...

...Et ideo dicitur aliter quod aliqui tales casus partiales bene possunt concedi, scilicet quod aliquando elementum moveatur ex se sine presentia motoris extrinseci et hoc quando elementum per actionem propriam removet impedimentum, sed hoc raro accidit, ideo simpliciter Aristoteles dixit quod elementum non movetur ex se sed a motore extrinseco."

[59] f. 80r: "Auctoritates autem Aristotelis et Commentatoris si alique sint in oppositum sunt glosande ad istum sensum quod bene generans et removens prohibens concurrunt ad hoc et requiruntur ad hoc quod grave incipiat moveri, licet non oportet ea esse continue ad hoc quod ipsum grave motum suum motum compleat."

survey of opinions on this subject, the decisive change in viewpoint came with John Duns Scotus.[60] It was Scotus, in his commentary on the *Sentences* with regard to the motion of angels as well as in his commentary on the *Metaphysics*, who first came to the conclusion that heavy and light bodies do in fact move themselves.[61] Scotus argued in this connection that it is not impossible for something to act on itself, especially when what is produced is not of the same nature as the power producing it. For Aristotle, the paradigm case for denying self-action was alteration: a body cannot heat itself because a heater must be hot, but to be heated the subject acted upon must initially be cool or at least less hot than the agent. This is a case of a univocal action. But in the fall of a heavy body the effect produced is different from the cause: the cause is heaviness or the substantial form of the heavy body, but the effect is to be in a low position. In such a case, Scotus argued, there is no reason why a heavy body cannot act on itself.[62]

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[60] Maier, *An der Grenze*, 164-5: "Die entscheidende Wendung kommt mit Duns Scotus. Er will beweisen dass auch die gravia und levia sich selbst bewegen, d.h. dass die Ursache ihrer Bewegung ein inneres Prinzip sei—aliquid intrinsecum ipsi gravi. vel ipsummet grave per aliquid intrinsecum... Damit ist eine neue Front geschaffen, die sich alsbald, schärfer als Duns es selbst getan hat, gegen die thomistische Lehre vom generans als Ursache der natürlichen Bewegung stellt. Zu ihr gehört übrigens ausser den Anhängern des Duns Scotus auch der Averroist Johannes von Jandun..."

[61] See John Duns Scotus, *Ordinatio*, Book II, dist. 2, part 2 De Loco Angelorum, Questio 5, Utrum angelus possit moveri de loco ad locum motu continuo, and Questio 6, Utrum angelus possit movere se, in *Opera omnia*, vol. VII, 278-374. According to Scotus, angels can move, they are not only moved miraculously, and they are not moved effectively by a body. Hence they must move themselves. But anything that moves itself, according to Aristotle, must be divisible into a mover and a moved, whereas angels are not so divisible. Faced with these constraints, and not doubting that angels can move themselves, Scotus was led to question Aristotle's claim that anything that moves itself must be divisible in two, into a first mover and a first moved. He argued first that angels can move themselves just as heavy and light bodies can move themselves. When it was objected that heavy and light bodies cannot so move themselves—as Aristotle says explicitly in Book VIII of the *Physics*—Scotus had to show that heavy and light bodies can move themselves. This then became a model for how angels can move themselves. See *Ordinatio*, 352ff.

[62] Ibid., 363: "Respondeo tunc ad Aristotelem, qui adducitur in contrarium, quod sit pro me (sicut adduxi),—quod grave moveat se effective, sicut sciens movet se effective ad actum speculandi. Et intelligo sic: sicut habens formam aliquam quae nata est esse principium alicuius actionis univocae, potest per illam formam agere in receptivum approximatum et proportionatum, sic etiam habens formam quae nata est esse principium alicuius actionis aequivocae, potest per ipsam agere aequivoce in passum approximatum; et si ipsummet sit receptivum illius actionis vel effectus aequivoci et carens eo, ex quo est maxime approximatum et proportionatum sibi ipsi, non solum poterit, immo summa causabit istum effectum in se ipso. Sic etiam est in proposito, quia lapis existens sursum, est in potentia ad ubi deorsum,—gravitas autem respectu

Clearly a heavy body can be an agent of downward motion, as it would be, for instance, if it pulled a light body attached to it downward. It can likewise be acted upon. So what prevents it from acting on itself?[63]

Buridan, in his commentary on the *Metaphysics*, also asked whether it is possible for the same thing to act on itself or to be acted on by itself (Book 9, Question 1). In the arguments *ad oppositum*, he acknowledged that Aristotle said that it is not possible.[64] Moreover, he said, if we conceded that the same thing could move itself, then there would be no way to prove that there must be intelligences moving the celestial bodies, against Aristotle's demonstrations.[65] This question, Buridan said, was treated in Books 7 and 8 of the *Physics*, and so he could pass over immediately to his conclusions. His first conclusion was that the same thing and in the same [part] of itself can act on itself and be acted on by itself, can move itself and be moved by itself.[66] For example, the soul does not only move the body subject to itself, indeed

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illius ubi est principium activum aequivocum, sicut universaliter respectu ubi non oportet ponere nisi principium aequivocum (non enim movens movet mobile ad aliquod ubi quia movens formaliter sit in actu secundum illud ubi, sed tantum quia virtualiter). Quia igitur ipsum grave est receptivum illius effectus aequivoci et caret eo, causat in se ipso primo istum effectum, et in nullo alio nisi causando prius in se..." I have removed the editors' quotation marks, which seemed to me to cause more confusion than clarification.

[63] Ibid., 360-1: "Praeterea, quod non movet aliud nisi prius ab alio naturaliter motum, ab eodem habet quod moveat et quod sit motum; sed grave cui alligatum est leve (cuius levitas non excedit gravitatem eius), movet idem leve, trahendo ipsum secum ad centrum,—et non movet nisi quia motum; igitur prius est motum naturaliter quam moveat. Et ab eodem movetur a quo movetur illud sibi alligatum: movet autem et illud per aliud, quia per gravitatem suam; igitur et se ipsum."

[64] John Buridan, *In Metaphysicen Aristotelis. Questiones argutissimae Magistri Ioannis Buridani in ultima praelectione ab ipso recognitae et emissae: ac ad archetypon diligenter repositae*, Paris 1518, Book IX, Questio 1, f. 56v: "Item in octavo *Physicorum* ipse arguit quod omnino idem non movet seipsum et secundum eandem partem, quia tunc (ut ipse dicit) idem esset in actu et in potentia respectu eiusdem, cum agens agat secundum quod in actu et passum sive motum moveatur secundum quod in potentia. Et hoc reputat impossibile. Et propter hoc etiam nititur Aristoteles probare in septimo *Physicorum* quod omne quod movetur movetur ab alio."

[65] Ibid., f. 56v: "Item si concederemus quod idem potest movere se vel etiam agere in se, sequeretur quod nulla esset via ad probandum quod oporteat esse intelligentias ad movendum corpora celestia, quod esset contra demonstrationes Aristotelis. Et consequentia est manifesta, quia statim possemus dicere quod illa corpora celestia moverent seipsa. Ideo non oporteret quod ab aliis moverentur."

[66] Ibid.: "De ista questione est aliqualiter tractatum in vii et viii *Physicorum* et ideo de ipsa est faciliter transeundum ponendo conclusiones. Prima est quod idem et secundum idem sui agit in se et patitur a se, movet se et movetur a se..."

it moves the whole thing together and any of its parts. Therefore it follows that it moves itself. And the same thing holds for heaviness, which moves the whole heavy body downward.[67] On the other hand, he said, in addition to God, who is a universal agent coacting in all other actions, all other agents acting on themselves do also have other assisting agents or things acted on. This Buridan showed by induction: the heavens do not move themselves, but are moved by the intelligences; heavy bodies require the medium that they divide; animals are moved by what is understood or desired. Thus it is clear that in all actions, besides the agent that acts on itself, other agents concur, either principal or dispositive agents. Or else there are other bodies acted on. In this sense, he said, all the authorities and arguments of Aristotle and his Commentator should be expounded.[68] Thus, in his commentary on the *Metaphysics*, Buridan "saved" Aristotle and Averroes by claiming that there are in fact always other agents or bodies acted on in any motion, despite the fact that agents can act on themselves. Faced with the same problem, Duns Scotus argued that, although heavy bodies can move themselves, nevertheless Aristotle's argument can be upheld because an external agent is required to generate a heavy body before it can subsequently move to its proper place.[69]

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[67] Ibid.: "Verbi gratia, anima non movet solum corpus sibi subiectum, immo totum compositum simul et quamlibet eius partem. Ideo sequitur quod ipsa movet seipsam. Et ita est etiam de gravitate que movet ipsum totum grave deorsum."

[68] Ibid.: "Secunda conclusio ponitur quod post principalitatem primi agentis, scilicet Dei, idem potest agere in se <et> pati a se tanquam principale agens et tanquam principale passum... Tertia conclusio: quod nihil agit in se sine adiutorio alterius agentis... Sed modo circumscribamus universalem Dei influentiam que ad omnem requiritur actionem iuxta illud. Proficit absque Deo nullus in orbe labor... Et tunc queritur utrum idem agit in se sine adiutorio alterius agentis vel alterius passi. Et respondeo quod non, prout potest videri per inductionem, primo de celo moto: non enim movet se sed intelligentia movet et orbis movetur. Deinde de gravibus quia grave licet secundum se totum moveatur, tamen non secundum se totum [*correxi ex* motum] movet. Materia enim non movet, quia nullius est activitatis. Et cum hoc oportet ibi esse aliud motum quod non movet ipsum grave, scilicet medium quod dividitur. Hoc apparet etiam de animali... Et ita apparet quod in omnibus actionibus preter illud agens quod agit in se concurrit aliquod aliud agens vel principale vel dispositivum quod non agit in se illa actione, vel etiam concurrit aliquod passum quod non patitur a se illa passione... Et ad istum sensum debent exponi omnes auctoritates et rationes Aristotelis et eius Commentatoris et rationes que fiebant pro secunda parte questionis. Nihil enim sic agit in se vel patitur a se quin aliud concurrat se habens in ratione agendi vel patiendi."

[69] Scotus, *Ordinatio*, 366-7: "Sed si obicis quomodo Aristoteles, si concedat grave sic moveri a se effective...quomodo habebit principale propositum suum, quod ista necessario moventur ab alio,—quod ipse intendit probare principaliter?,—dico quod

Roy Effler, in explaining Scotus's position on the self movement of heavy bodies, notes that Scotus presented his departure from Aristotle and Averroes as if it were not a departure, and he describes this as the venerable medieval practice of "interpretation" or "reverential exposition."[70] Scotus, he says, was quite aware that, except in the case of substantial change, he was rejecting Aristotle's principle that everything that is moved is moved by something else. If he did not say so explicitly, Effler believes, it was only because that was not the normal and polite approach to exposition of an authoritative text.[71]

Effler goes on in his discussion to make another point. Scotus, he says, was preceded by Avempace in the theory that a heavy body causes its own downward motion. Avempace, however, treated the accidental form of heaviness of the heavy body as the mover and its matter as the moved. This, according to Effler, for Scotus, as for Averroes and others before him, is impossible, because according to Scotus the form of a body cannot act on its matter at least in the case of inanimate substances.[72] For this reason, according to Effler, Scotus said that the mover is not the form of the heavy body, but the heavy body itself by means of its heaviness. In this way the heavy body in its entirety is both the mover and the moved—but this is also in clear opposition to Aristotle.

We can see how this problem appeared to the scholastic commentators in the period between Scotus and Buridan by looking at the *Physics* commentary of John of Jandun. In his eleventh question on

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satis habet hoc ex distinctione potentiae. Ista enim non reducunt se ipsa de potentia secunda ad actum, nisi prius fuerint reducta de potentia prima ad actum primum vel saltem possent reduci ad actum primum... Sequitur igitur quod licet grave et leve moveant se de potentia secunda ad actum secundum, tamen mobile est vel movetur ab aliquo alio extrinseco, a potentia prima ad actum primum; non enim oportet quod si omne quod movetur, ab alio movetur, quod in omni motu moveatur ab alio,—et sufficit Philosopho primum, quia per hoc devenitur ad aliquod aliud ab omnibus istis, quod nec in uno motu, nec in quocumque, poterit moveri ab alio sed est omnino movens immobile." Again I have removed the editors' quotation marks.

[70] Roy Effler, *John Duns Scotus and the Principle "Omne quod movetur ab alio movetur"*, St. Bonaventure, NY 1962, 113, 122, (Franciscan Institute Publications, Philosophy Series, no. 15).

[71] And in some cases Scotus is explicit that Aristotle is wrong or contradicts himself. Cf. Effler, 122, and *Ordinatio*, 355: "Et si dicas quod illa non est intentio sua (quamvis sic sonent verba), quia II *De generatione* enumerans qualitates activas excludit grave et leve a qualitatibus vere activis et passivis,—respondeo: Dico quod contradiceret sibi ipsi in VIII *Physicorum*, per illud II *De generatione*, nisi alio modo intelligeret hic et ibi..."

[72] Effler, 125.

Book 8 of the *Physics* Jandun asked whether an inanimate heavy body moves itself. His principal and other arguments on the subject include virtually everything that Buridan, Albert of Saxony, Marsilius of Inghen, and "John Marsilius Inguen" later discuss. Jandun phrased the second principal argument of his eleventh question (Whether an inanimate heavy body may move itself) as follows:

> Also, what is divided into a moving part and a moved part moves itself, as is clear in this Book 8. But an inanimate heavy body is of this sort, for it is divided into matter and form, and the form is the mover and the matter is the thing moved, as the Commentator says in Book 4 of this work. And if you say to this that the matter of the heavy body cannot be that which is *per se* moved downwards, because what is moved should be an entity in act, and this matter of the heavy body is not an entity in act, against this is the argument that an animal is said to move itself in that it is divided into a body and a soul, which <body> is a part of the animal opposed to the soul, but is not some entity distinct besides the soul, as is commonly said. Therefore it is similar in this case: although the matter which is part of the stone is not an entity in act besides its substantial form, it could nevertheless be moved *per se*. As the soul is the *per se* mover despite the fact that it is the act, so the form of the stone could be the *per se* mover, so it seems.[73]

In his reply to the main question, Jandun was particularly interested in the proximate cause of the motion of a heavy body downwards. He said:

> Whether, then, this heavy body may move itself, concerning this there is great difficulty and diversity among the doctors. Many if not all of them say that this sort of heavy body existing in act <and> in accidental potentiality to a lower place does not move itself *per se* but only *per accidens*. If it moved itself by itself, then it would be necessary that it be divisible *per se* both in a part moving *per se* and in a part *per se* moved. But according to Aristotle in this Book 8 this is impossible, as is clear from what he says. For those parts either must be quantitative parts of the heavy body or essential parts, by a sufficient division. They are not quantitative parts, because the quantitative parts are alike in disposition and power according to quality, so that there is no reason why one part would be the mover *per se* and the other the moved part *per se*. Nor are the parts essential parts, because the only essential parts are the form and prime matter. But prime matter cannot be moved *per se*, since it is an entity in pure potency and has no resistance to the mover. And there must always be resistance, as the Commentator says in Book 4 of this work. Therefore this heavy body does not move itself by itself.[74]

Having argued against this position and against other positions, for instance the position that the natural place contains the power that moves the heavy body down, Jandun concluded:

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[73] See Appendix.

[74] See Appendix. It appears to me that the wording on this issue in Buridan's and Albert's commentaries, for instance the use of the subjunctive in phrasing the question whether a heavy body may move itself or the interest in motion *per se* as opposed to *a se* and *ex se*, has echoes of Jandun.

> I believe that it can be said with probability that this sort of heavy body is a *per se* mover of itself.[75]

But against this conclusion Jandun again raised the authority of several passages in Aristotle and Averroes and also several arguments, including the argument that prime matter cannot be what is primarily moved. If it cannot be the matter, so the argument went, then it must be the form that is primarily moved and then the same substantial form will be both active and passive with respect to the same effect, "which seems entirely absurd."[76] Furthermore, he went on, if a heavy body moves itself *per se*, then Aristotle's proof of the existence of unmoved movers will have no efficacy, which would be very unsuitable. "Thus it would seem that Aristotle's argument would be totally worthless, which would be foolish to concede."[77]

In reply to the authoritative texts, Jandun claimed that Aristotle's denial that heavy bodies move themselves only applies to the reduction of the essential potentiality to act, that is to the generation of the heavy body, and not to the reduction of the second or accidental potentiality to act, namely to the motion downward.[78] This is the same tack that

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[75] Ibid., f. 116v: "Et credo quod probabiliter posset dici quod huiusmodi grave est per se motivum sui ipsius."

[76] f. 117va: "Ergo ipsa materia non est illud ratione cuius grave recipit suum motum. Et sic relinquitur quod recipit ipsum secundum formam. Et constat quod agit ipsum secundum suam formam substantialem principaliter. Et sic erit activum et passivum simul secundum idem et respectu eiusdem effectus, quod videtur omnino absurdum, quare etc."

[77] f. 117v: "Item si grave esset suiipsius per se motivum, tunc probatio Aristotelis qua voluit convincere aliquem esse motorem immobilem nullam efficaciam haberet, quod est valde inconveniens. Et patet consequentia, quia illa ratio Aristotelis principaliter sustentatur super eo quod omne quod movetur ab alio movetur et quia non proceditur in infinitum in moventibus et in mobilibus oportet devenire ad motorem qui non movetur... Et sic videtur quod ratio Aristotelis non valeret omnino, quod est fatuum concedere, quare, etc."

[78] f. 117v: "Ad primum istorum dico breviter quod Aristoteles non intendit negare nisi quod ipsum grave inanimatum movet seipsum per se de potentia essentiali ad actum, non autem dicere vult quod non sit per se motivum suiipsius de potentia accidentali. Et hoc modo pono ipsum movere seipsum per se, id est per sui naturam... Sed actu grave bene potest habere principium per se activum sui descensus, et per se principium receptivum modo prius dicto. Nec istud intendit Aristoteles, ut puto, negare. Verum enim est quod actu grave non indiget motore per se extrinseco, et hoc plane dicit Commentator in isto capitulo... Per idem ad auctoritates Commentatoris, cum ipse dicit in Tertio *Coeli et Mundi* quod declaratum est de elementis quod non moventur, dico quod ipse intendit ea non movere seipsa de potentia essentiali ad actum, sed ex tali potentia moventur a generante. Et hoc est quod subdit, cum non moventur in loco nisi a generante. Hoc enim non potest intelligi de motu gravis actu existentis in potentia accidentali, quia contingit cum tale grave movetur, generans

Scotus took to save Aristotle's proof of the existence of unmoved prime movers, but, again, it may be "reverential exposition," since Aristotle explicitly said that heavy bodies do not move themselves in natural motion. In reply to the other arguments, Jandun said that the substantial form of the heavy body is the mover in natural motion, and the same substantial form insofar as it is in matter receives the motion. Thus, like Scotus, he avoided referring to prime matter as what is moved, but at the price of having the same thing being both the mover and what is moved, though not in the same way:

> I say, however, for the sake of the younger, that for the Commentator it is not unsuitable that one and the same thing at the time and in the same essential part, namely according to its substantial form, have an active potency and a passive or receptive potency *per se* for the same thing, but in a different way. But in the same way it is indeed impossible. Now I say that the heavy body in act by its form has the active <potency> of its motion and insofar as it is form, and by it [the form] it has a receptive potency of its motion insofar as it is in matter.... By this same argument it can be said to the common argument that the same thing at the same time and in the same respect will be in act and in potency with respect to the same thing, this is true; but not for the same reason or in the same way, but in different ways. And this is not unsuitable.[79]

Jandun closed the question with this response to the principal arguments:

> To the arguments raised at the start of the question, they do not hold against this position, but that there is a defect in them will be clear to anyone who diligently inspects them. This is what I was able to collect about this difficult question. If anyone does not accept what I have written, it is just that he disprove it by demonstration and resolve the arguments in its favor. Otherwise such a person should not be believed. Let those who come later, soul friends more of truth than of fame, know that I have not proved this position entirely by my own invention, but from what has been passed on by a certain doctor of theology, whom I regard as one of the most subtle expositors of Aristotle and his Commentator among my contemporaries. I have added, however, some things to the

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quod est corruptum. Relinquitur quod ipse intelligit de illo motu cui correspondet potentia essentialis."

[79] f. 118v: "Dico tamen propter iuniores, quod secundum Commentatorem non est inconveniens unum et idem simul et secundum eandem partem essentialem sui, scilicet secundum formam substantialem suam, habere potentiam activam et potentiam passivam sive receptivam per se eiusdem alio et alio modo, sed eodem modo bene esset impossibile. Modo, dico quod actu grave per suam formam habet <potentiam> activam sui motus, et inquantum est forma, et per eam habet virtutem receptivam sui motus, inquantum est in materia... Et causa in hoc quod invenitur uno modo in actu et alio modo in potentia est quia componitur ex materia et forma. Forma igitur eius movet in quantum est forma et movetur secundum quod est in materia... Per idem potest dici ad unum argumentum commune, quod idem simul et secundum idem erit in actu et in potentia respectu eiusdem, verum est, sed non ratione eiusdem et eodem modo, sed alio et alio modo. Et hoc non est inconveniens."

> ordered demonstration and confirmation of this position, which have not been taken up by others unless by Aristotle and the Commentator, which, if they are probable and true, should be held, and if they are not, should be eliminated by demonstrative arguments until finally the truth of this most difficult problem will be apparent.[80]

Although Duns Scotus died in roughly the same years that Jandun was writing this, he must be the subtle expositor to whom Jandun refers. Jandun was, then, the likely channel through which Scotus's arguments in a theological context came into commentaries on Aristotle's *Physics*.

One other passage from Jandun in this context is revealing. It is the final remark in Jandun's treatment of the question whether an animal moves itself. His conclusion is that an animal moves itself in the sense that in the animal there is a soul that is the mover and a body that is moved. Against this conclusion there was the argument, as in the case of heavy and light bodies, that the conclusion is false because the only essential parts of animals are matter and form and the matter cannot be what is moved because it is not an entity in act. In response, Jandun conceded that the objection is difficult to reply to, but claimed that body, as an essential part of an animal and essentially distinct from the soul, is not prime matter separate from all substantial act, but indeed is a sort of entity in act compounded of prime matter and form, without substantial form in act really different from the soul. By this actuality the body can be subject to motion. In this way the composition of animals from body and soul differs from the composition of a stone from matter and form. "I concede," he says, "that in an animal there is another substantial form besides the specific soul:"[81]

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[80] ff. 118vb-119ra: "At rationes in principio quaestionis adductae non concludunt contra hanc positionem, sed quod defectus sit in eis patet diligenter inspicienti praedicta. Haec sunt quae de ista difficili quaestione potui congregare, quod si quis positionem quam scripsi non acceptet, iustum est ut eam demonstratione improbet et rationes pro ea solvat. Aliter enim non est ei credendum. Sciant etiam Posteriores veritatis plus quam famositatis in animis amici, quod hanc positionem non omnino probavi ex inventione mea, sed ex traditionibus cuiusdam doctoris Theologi, quem inter meos contemporaneos puto unum de subtilibus expositoribus Commentatoris et Aristotelis. Addidi tamen aliqua ad ordinatam huius positionis declarationem et confirmationem, quae ab aliis non suscepi nisi ab Aristotele et Commentatore, quae, et si probabilia sunt et vera, teneantur, si autem non, removeantur rationibus demonstrativis. Et sic tandem huius difficillimi problematis veritas apparebit."

[81] f. 114v: "Quod autem additur de materia, quod non possit esse mota per se, difficilis est. Tamen dico breviter ad presens quod corpus quod est pars essentialis animalis distincta essentialiter ab ipsa anima non est ipsa materia prima sine omni actu substantiali, immo est quoddam ens actu compositum ex materia prima et forma sine actu substantiali alia ab anima realiter, per cuius actualitatem potest subiici

> And you say, therefore you concede degrees of form and a plurality in the same individual. Certainly, I say that this is true. And I have proven it elsewhere separately. And I have replied to what is objected against it. And in my opinion this was the intention of Aristotle and the Commentator, as was also clear in the same place. Indeed that position was famous at one time among all the ancients, but after the time of Albert and Thomas it was made rather improbable because of their fame, and because of some superficial arguments made by them, which they adduced against that position. And perhaps its probability will return again, when the efficacy of the arguments for it are seen, as well as the weakness of the arguments disproving it.[82]

In sum, the position on the cause of the motion of heavy bodies taken by John Buridan, Albert of Saxony, Marsilius of Inghen, and "John Marsilius Inguen" was a position previously elaborated by John of Jandun based on earlier ideas of Duns Scotus. In the work of Jandun with regard to animals, it was clear that the position depended to a greater or lesser extent on an acceptance of the plurality of forms and on a rejection of the arguments of Albert and Thomas for the unity of substantial forms. With regard to inanimate bodies, on the other hand, John of Jandun's response to the third principal argument was, in effect, that it is not the matter that is moved, but the substantial form insofar as it is in the matter. The Parisian nominalists agree with Jandun that after a heavy body has been generated and after whatever prohibits its motion has been removed, it is the form of the heavy body—the substantial form or the heaviness—that moves it downwards. They also agree with Jandun that, in contrast to the situation with animate bodies, in inanimate bodies the rest of the body, abstracting from the intrinsic mover, does not resist natural motion, so that if motion is to take time rather than occurring instantaneously, a medium must resist. Unlike Jandun, however, the Parisian nominalists deemphasize the issue of what it is that is moved, whether it is prime matter, or quantified matter, or the form insofar as it is in matter, or the whole body, etc. In his very brief answer to the second

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motui. Et in hoc differt compositio animalis ex corpore et anima a compositione lapidis ex materia et forma... Concedo ergo in animali esse aliam formam substantialem preter animam specificam, quam consequitur virtus motiva."

[82] f. 114va: "Et tu dices, ergo concedis gradus formarum et pluralitatem in eodem individuo. Certe dico quod hoc est verum et alias probavi seorsum et dixi ad ea quae in contrarium huic obiciuntur. Et puto istam fuisse intentionem Aristotelis et Commentatoris ut ibidem patuit. Immo illa positio aliquando fuit famosa apud omnes antiquiores, sed post tempus Alberti et Thomae aliquantulum facta est improbabilis propter eorum famositatem et propter quasdam rationes eorum superficiales, quas ipsi adduxerunt contra istam positionem. Et forte iterum revertetur probabilitas eius, cum visa fuerit efficacia rationum eius et debilitas rationum ipsam improbantium."

principal argument of his Question 5, Buridan seems to say, indeed, that it is matter that is moved.[83]

That it was Jandun (and to a lesser extent Scotus) who was credited with originating the position on what causes the natural motion of inanimate bodies can be confirmed by looking at the late fifteenth-century work of Nicoletto Vernia, mentioned at the start of this paper. Vernia begins his *Tractatus de gravibus et levibus* by saying that he was motivated to discuss the issue since especially the more modern expositors had written either badly or incompletely about it.[84] In the first part of his question, then, Vernia discussed the views that he believed to deviate from Aristotle, dividing them into Greek, Arabic, and Latin. Representing the Greeks he included only Plato, representing the Arabs, he included only Avempace, and among the Latins, he argued against the views of Albertus Magnus, Thomas Aquinas, Aegidius of Rome, John of Jandun, John Duns Scotus, certain theologizers, unnamed philosophers who held that heavy bodies are moved by their proper places, and others who held that they are moved by their form but by accident.[85] By far his longest treatment was devoted to John of Jandun, whose view was, in his judgment, "remote from all truth."[86] If it were true, he says in what should be by now a familiar argument, it would destroy Aristotle's whole line of argument in Book 8 of the *Physics*, where he proved the immobility of the prime mover.[87] It would be ridiculous, Vernia said, to say that Aristotle's argument is vacuous. As Averroes says in Book 1 of *On Generation*, according to Vernia:

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[83] Buridan, f. 114v: "Secunda ratio bene probat quod hec non est per se vera grave movetur, sed tamen grave per suam materiam movetur, quia illa est principium illius motus passivum."

[84] *Nicholeti Theatini Questio De gravibus et levibus* (Padua, 1474?/1476), f. 174va: "Ego tamen...volui hoc anno opus *De Celo* interpretari, qui liber tum ex ipsius Philosophi dispositione, tum ratione doctrine secundum esse debet. Quam rem etiam Averrois ut fuit arabus solertissimus in explananda Aristotelis philosophia servandam esse tradidit. Nam secundum locum huic operi assignavit. Verum cum Aristotelis in tertio operis huius volumine motorem gravium et levium inquirat, in qua materia invenio expositores eius presertim novos aut male dicere aut diminute scripsisse."

[85] Ibid., f. 175ra: "Inter Latinos vero invenio Albertum voluisse quod gravia et levia, cum fuerint generata remoto prohibente, moveantur a seipsis per accidens dividendo medium per se ad cuius motum ipsa moventur..." f. 175rb-va: "Post istum inter Latinos invenio gloriosum doctorem Sanctum Thomam de Aquino compatriotam nostrum, qui voluit quod gravia et levia a se ipsis formaliter, effective autem a generante moveri... Non habet, igitur, grave in se ipso aliquod principium activum sui motus, sed passivum tantum." f. 175va: "Post eos invenio Egidium de Roma qui in motu naturali concordavit cum Alberto... Ideo grave movetur a se ipso deorsum per accidens." 175va-b: "Post eos invenio Johannem de Ganduno voluisse quod gravia et levia postquam sunt generata a se, id est a suis formis substantialibus, moventur ita quod eadem forma secundum eum est per se movens et per se mota. Movet enim in quantum est forma et movetur in quantum est in materia." 176ra: "Unde opinio Scoti de motu gravium est conformis multum opinioni Johannis [de Ganduno] unde concedit ipse grave a se ipso moveri... Sed numquid in omnibus conveniant non curo ad presens declarare." 176va: "Post hos invenio quosdam theologizantes qui voluerunt quod moventur a gravitate tanquam ab agente principali et primo... Post hoc invenio quosdam dicere quod moventur a loco..." 176va-b:

> the first master never says anything without a strong reason. And the same Commentator in *On the Heavens*, Book 4, comment 25, says that the argument given by Aristotle in Book 8 to prove that one ultimately arrives [at a first unmoved mover] is sufficient and stronger than the argument given in Book 7.[88]

In the second part of his question, then, Vernia described what he said was Averroes's view, which he took to be in line with Aristotle's intent. According to this view, after a heavy or light body is generated and after anything preventing its motion has been removed, then, if it is out of its natural place, it is moved there naturally by the air, which has been given impetus by what removed the impediment to its motion.[89] This view, Vernia claimed, is expressly stated by Aristotle

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"Post hos invenio quosdam alios dicere quod ipsa moventur a suis formis per se que tamen non per se seipsas movent, ut Johannes dixit, sed per accidens movendo compositum per se."

[86] Ibid., f. 175vb: "Sed iudicio meo illa opinio est ab omni veritate remota."

[87] Ibid., f. 176rb: "Item illa opinione data destrueretur totus processus Philosophi octavo *Phisicorum* ubi probat immobilitatem primi motoris et quod est devenire ad primum motorem simpliciter immobilem." Elsewhere, discussing Scotus's claim in Book II of the *Sentences* that something can act on itself, Vernia says that he is amazed that such a great man as Scotus would deny a metaphysical principle. f. 176r: "Sed doctor subtilis secundo *Sententiarum* distinctione 29 et in *Quolibetis* dicit quod illa propositio agens quod est virtualiter tale non potest facere se formaliter tale est falsa, et si est vera, non est vera nisi gratia materie in qua est... Sed miror de tanto viro quod istud principium methaphisicum neget... Unde si ipse verum diceret, destrueret totum processum Philosophi in octavo *Phisicorum* ut supra dictum est et infra statim tangetur. Unde opinio Scoti de motu gravium est conformis multum opinioni Johannis. Unde concedit ipse grave a se ipso moveri ut patet distinctione secunda secundi *Sententiarum* ita quod grave per gravitatem producit in se motum etc." This is the only passage where Vernia acknowledges that Scotus's opinion on this matter is essentially the same as Jandun's.

[88] Ibid., f. 176rb-va: "Et sic ratio Aristotelis nulla esset, quod ridiculosum est dicere de eo. Nam Magister primus, ut ponit Commentator primo *De Generatione*, nunquam aliquid dixit sine forti ratione. Et idem Commentator quarto *Celi* textu commenti 25 vult quod ratio aducta ab Aristotelis in octavo ad probandum quod est devenire etc. est sufficiens et sufficiencior illa que tacta fuit in septimo."

[89] Ibid., f. 176vb: "Quantum ad secundum dicendum est cum Averroe (quem solum inter nominatos philosophos verum dixisse et Aristotelis habuisse intentionem existimo) quod gravia et levia postquam sunt generata remoto prohibente movet per

in Book 3 of *On the Heavens*, where he says that the power uses the air as an instrument in both natural and violent motion.[90]

Thus Vernia gives a solution to the question—that the remover of the impediment gives impetus to the medium that in turn moves the heavy body down—not given by previous natural philosophers in such detail for the case of naturally moving bodies. But abstracting from this idiosyncratic twist to his answer, he otherwise gives a response that might be expected of someone who respected Aristotle's authority, including Aristotle's conclusion that heavy bodies do not move themselves in natural motion.

Slightly later than Vernia, Girolamo Pico, without naming Vernia other than to call him "a man of our era," took up the same question with the aim of clarifying Vernia's views insofar as they were true, or otherwise correcting them.[91] Eight views on this matter have been found, according to Pico, that contradict Aristotle. The ninth opinion, which Pico supported, was the opinion of John of Jandun. According to this opinion, Pico said, heavy and light bodies are moved from their

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se et naturaliter ad sua naturalia loca, cum fuerunt extra illa, ab ipso aere moto a removente prohibens. Et quod ab eodem aere moto mediante impetu ei dato a movente per violenciam, dum per violentiam modo moveantur omnes philosophi convenerunt."

[90] f. 176vb: "Hec sentencia expresse colligitur ab Aristotele tertio *Celi* textu commenti 28. Dicit quod potentia utitur aere in utroque motu tanquam instrumento. Et Commentator ibi dicit quod grave iuvat gravitate et leve iuvat levitate et quod movet illa in utroque motu.

Unde in translatione nostra sic inquit: ipsa ad ambo utitur aere tanquam organo, eadem igitur que sursum facit lationem facit etiam deorsum. Hoc idem quantum ad motum eorum naturalem potest probari per rationem tactam contra Iohannem et alias opiniones. Nam cum illa per se moto remoto prohibente ad sua loca naturalia et effectus per se requirit causam per se et illa non potest esse nisi aer, quia neque forma movetur neque locus et sic de aliis, ergo etc."

[91] *De motu gravium et levium*, MS. Venice, Bibl. Marc. VIII 83, f. 4r: "In hac materia inter omnes physicas difficultates subtilissima servabo ordinem unius viri qui etatis nostre corona existimabatur et ample de huiusmodi materia tractavit ut quantum veritatis eius dicta contineant clarius patefiat. Duo igitur faciam. Primo recitabo opiniones que Aristoteli, Averoyque, adversari videntur, eas impugnando et quantum benedixerit iste vir in contradicendo illis ostendam. Secundo ponam opinionem quam credo esse Aristotelis et Averoys fortiores argumentationes que communiter contra illam adduci solent resolvendo." On this work see Charles Schmitt, *Hieronymus Picus, Renaissance Platonism and the Calculator*, in: International Studies in Philosophy, 8 (1976), 57-80. Anneliese Maier mentions, *An der Grenze*, 207 n. 44, that Pico follows Vernia's exposition of the question although rejecting his view. Pico derives his view of impetus, according to Maier, from Albert of Saxony. I would like to thank Edward Mahoney for providing me with reproductions of Venice, Bibl. Marc. MS lat. VIII, 83 and for encouraging me to work on the relations of Pico's work to Vernia's.

essential potency by the generator, from their accidental potency by the remover of the impediment to their motion, and their motion is continued by the substantial form as principal agent and by their accidental form as instrumental agent.[92] The basis of this opinion, Pico said, is that every effect that is intended *per se* must have some agent *per se*, but the motion of heavy bodies down is an effect intended *per se*, therefore it must have an agent *per se*. That *per se* agent cannot be anything else than the substantial form.[93] In this way Pico reaffirmed what Anneliese Maier describes as the dominant view of the later Middle Ages on this question, that is the view of Jandun and of the Parisian nominalists, a view that diverges from the original Aristotelian position.

Judged by this brief look, then, at the perspective of Vernia and Pico in the late fifteenth century, it could perhaps be guessed that the Parisian nominalists did not emphasize their deviation from Aristotle because they were adopting a position that had already achieved a certain acceptance. Their repetition of what seems to be the standard third principal argument against their position—that there was nothing in act to be moved if the form of an inanimate body was the mover—could be explained simply by the fact that this principal argument was part of the standard discourse. In fact, and perhaps this should have been said much sooner, the argument is explicitly in Averroes, if not implicitly in Aristotle himself. In his Comment 30 on Book 8 of the *Physics*, Averroes said:

> If therefore someone said that these are simple bodies composed of matter and form, of which each is distinct according to definition from the other, we say to this that prime matter does not exist in act. And what is moved from within ought to be divided into a mover and a moved in act, since what is in potency neither is moved nor moves. If therefore a stone, for example, were moved from within, it would happen that it was the mover and the moved in the same way according to its form, because there is nothing existing in act [in it] except form. But this is impossible. ...what is moved from within will be divisible into parts

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[92] ff. 11v-12r: "Nona opinio est Johannis de Janduno quam credo esse Aristotelis et Averoys tenentis gravia et levia moveri de potentia essentiali a generante, de potentia accidentali initiative a removente prohibens, continuative a formis substantialibus tanquam ab agente principali et a formis accidentalibus tanquam ab agente instrumentali."

[93] f. 12r: "Cuius fundamentum erat istud: omnis effectus per se intentus ab aliquo indiget aliquo agente per se, sed motus gravis deorsum est effectus per se intentus a natura gravis, ergo indiget agente per se. Tale agens non est generans, non removens prohibens, quum ista possint non esse, et tamen movens et motum debent esse simul. Item tale agens non locus, non aer, non forma accidentalis, ergo forma substantialis."

> either according to definition or according to quantity. Since simple bodies are not divided either way, it follows that they are not moved from within in any way.[94]

Perhaps, however, it was not just that many later commentators on the *Physics* picked up this argument from Averroes, but also that in the meanwhile the controversy over the plurality of substantial forms had reinforced the argument that in a simple body, abstracting from the substantial form as mover, there is nothing in act to be moved: unless, that is, like Jandun, one says that it is the same form insofar as it is matter that is moved as well as being the mover, or unless one supposes that a body can be said to be in act, in the sense required, by an accidental rather than a substantial form—it is the latter tack that Albert of Saxony takes. As representative of the position reinforcing this argument of Averroes in the period between Averroes and Scotus, Aegidius Romanus might be mentioned. Coming to the pertinent passage of Book 8 of the *Physics* where Aristotle argues that homogeneous continua cannot move themselves, Aegidius makes the standard distinction between essential and quantitative parts and says that in neither sense is a homogeneous body divisible into a mover and a thing moved. After a long argument, he supports the older view that it is the generator that is the efficient cause of natural motion downward, while the heaviness serves as a formal cause.[95]

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[94] See Appendix. In the margin next to this solution there is the remark: "Ex hoc videtur velle quod non sint plures forme substantiales in simplicibus. Consimile 4 *Coelo*, c. 22, et 4 *Phys.* 71. Vide con. Zim." This last refers to a work at the end of the volume: Marcus Antonius Zimara, *Solutiones Contradictionum in dictis Aristotelis et Averrois*, quoted above.

[95] Aegidius Romanus, *Commentaria in octo libros phisicorum Aristotelis*, Venice 1502, Unveränderter Nachdruck, Frankfurt 1968, f. 192v: "Dubitaret forte aliquis utrum he quatuor rationes [Aristotelis] adducte vigorem habent... Quarta vero ratio innititur huic fundamento quod omne quod movetur ex se habet partes diversarum rationum, quia est divisibile in movens et motum que secundum quod huiusmodi in unam rationem non coincidunt... [See Appendix for the rest of this argument.] Philosophus ergo premittit hunc modum quod corpora simplicia non moveant seipsa quasi forma moveat materiam cum quasi per se notum sit materiam non posse esse illud quod per se movetur cum mobile et motum non dicat potentiam puram sed dicat potentiam admixtam actui. Cum enim ipse motus sit quidam actus, impossibile est quod movetur non esse quodammodo in actu. Hoc igitur modo praetermisso, improbat alium modum quod corpora simplicia non movent seipsa quod una pars quantitativa moveat aliam...

Ulterius viso quomodo predicte rationes concludunt forte dubitaret aliquis quia videtur quod gravia et levia seipsa moveant per se. Nam ei quod per se movetur oportet respondere per se movens, si grave deorsum descendens per se movetur, quod patet per id quod dictum est de per se moto... Dicendum quod inscribitur 5° *Metaphysice* capitulo de per se: per se dicitur equaliter cause. Quot enim modis diver-

After all this, where do we stand with regard to the nature of the Aristotelian commentary tradition as practiced by the Parisian nominalists? I began this research with the assumption that the *Physics* commentaries of the Parisian nominalists would be an ideal place to start in trying to understand how scholastic Aristotelian commentary traditions worked. These commentaries are closely related works by some of the best medieval natural philosophers, and I thought I could examine how the later commentators used the commentaries of the earlier authors, as well as the texts of Aristotle, other textual sources, and the phenomena of nature. Moreover, I chose the issue of why heavy bodies move down because it was said at the end of the fifteenth century to be the weightiest of physical problems.

A comparison of the commentaries of Buridan, Albert, Marsilius, and "John Marsilius Inguen" on this issue shows that later commentators did not particularly try to assert their own originality. Although the Parisian nominalists' views diverged significantly from Aristotle's, ways were found to justify and explain why Aristotle and Averroes could rightly have said what they did. Moreover, later commentaries used earlier commentaries freely as sources with no concern about what we might call plagiarism.[96] Not only did later commentators make use of the work of their predecessors, however, but this occurred to the extent that the manuscript traditions of the works of different commentators became mutually entangled at an early date. In this single study I have not been able to differentiate fully the work of Buridan from that of Albert of Saxony. One clear conclusion to be drawn from this project is that more work remains to be done to identify separable versions of Aristotelian commentaries and to differentiate them one from another. Only when this has been done can one

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sificatur causa tot modis potest diversificari quod est per se... hoc ergo modo motus deorsum reduci habet in grave tanquam in causam materialem per se. ...si vero loquimur de motu huius secundum quod reducitur in causam formalem, sic etiam non est inconveniens motus gravis deorsum reduci in ipsum grave tanquam in aliquid per se... [f. 193r] ...Nam huiusmodi motus effective est a generante, formaliter autem est a forma gravis. Non ergo est inconveniens huiusmodi motum reducere in ipsam naturam gravis tanquam in principium per se sed non tanquam in principium effectivum, sed magis quasi in principium formale, quare loquendo de principio effectivo gravia seipsa non movent."

[96] Moody, comparing Albert of Saxony's commentary on *De Caelo* to Buridan's, says, xxi-xxii: "Buridan's...pupil, Albert of Saxony, wrote a similar set of *Quaestiones* which turn out, on examination, to be little more than a rewriting of Buridan's work, with a few additions and alterations. All the ideas in Buridan's work are taken over by Albert, often in almost the same language..."

begin to study how later commentators relate their work to that of their predecessors. Perhaps the conclusion to be reached is that it is impossible to untangle fully the work of different individuals.

The Parisian nominalists seem to have started from the presumption that Aristotle was an authority in physics, but not to have believed that his views were unquestionable. Since Aristotle seemed to be inconsistent with regard to the explanation of the natural motion of the elements, his texts invited efforts at interpretation. The Parisian nominalists, then, tried to "save the phenomena" in the broad sense of explaining what happens in the world and at the same time explaining what Aristotle and Averroes could reasonably have intended in their texts.

In my reading of the texts, however, I found a perplexing gap in Buridan's reasoning, represented by his glossing over the objection to his view that prime matter cannot be the thing moved because it is not a separate entity in act. Finding an earlier holder of Buridan's view in John of Jandun—with John's characteristically outspoken statement of the tension at this point in the theory—confirmed my sense that something was missing in Buridan, showing how someone who reached the same conclusions as Buridan might, at the time, have been expected to reply. Reading Vernia and Pico confirmed the view, however, that it was John of Jandun (although he built upon arguments of John Duns Scotus) who was given credit or blame for innovation on this question, whereas the Parisian nominalists were considered to be following his lead.[97] Perhaps the whole issue was noncontroversial at the time of Buridan, although for Vernia more than a hundred years later it was still very much alive.

One conclusion that might be reached on the basis of this line of inquiry, then, is that, although I tried to choose what contemporaries thought was a serious question, I nevertheless chose one on which the authors I chose did not have much original to say—or on which there was not much controversy at the moment at which they were writing, though there was controversy before and after. One might suppose, then, that this is a case study of how an Aristotelian commentary tradition works with regard to a question on which the authors do not have new ideas or very strong or idiosyncratic opinions. If I had chosen a subject that was more controverted in the mid-fourteenth century, perhaps I might have found a different story.

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[97] Vernia mentions Albert of Saxony under the names Albertus Parvus (175r) and Albertutius (177r), Marsilius (177v), Gaetano of Thiene (175r, 177r), and *alios terministas* (177r). He does not mention Buridan by name. Nor does he give any of the terminists' views on the cause of the natural motion of elemental bodies. Albert of Saxony, rather than Buridan, may have been Vernia's main source for the ideas of the Parisians. Otherwise, as the foundation of his treatment, he seems to have used Burley's exposition and questions on the *Physics*, and, of course, he owned John of Jandun's work.

This was not, however, the first direction in which my thoughts turned after I moved back from reading the works of the Parisian nominalists on this question to reading John Duns Scotus and John of Jandun. My initial reaction was that if the conclusion that heavy and light bodies move themselves was opposed to Aristotle and controversial for Scotus and Jandun, not long before Buridan, and if the issue had implications that reached out to a number of controverted theological questions, then perhaps Buridan and his followers were, by their seeming blandness, somehow attempting to avoid being caught up in theological quarrels—one might even suppose that they were following the university regulation that members of the arts faculty should not deal with theological matters.[98] Along these lines, I asked myself whether Buridan's apparent empiricism and easy-going search for the truth did not conceal an effort to avoid heated doctrinal controversies between opposing schools of thought. In several cases, I noticed, Buridan said, in effect, if you believe A, then this is how I explain it, but if you believe B, then I have an alternative explanation. He said something like this, for instance, with regard to the issue of whether a celestial mover is to be taken together with the sphere it moves as one. Elsewhere, he said as an aside that perhaps only humans with free will and not other animals can initiate motion with no change in the external circumstances—something that opposed the whole tenor of his conclusion, but which he left for another occasion.[99]

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[98] English translations of some of the relevant documents are conveniently available in Edward Grant, ed., *A Source Book in Medieval Science*, Cambridge, Mass. 1974, 42-52. So Buridan says, in Book IV, question 8, of the *Physics*: "some of my lords and masters in theology have reproached me on this, [saying] that sometimes in my physical questions I intermix some theological matters which do not pertain to artists. But with [all] humility I respond that I very much wish not to be restricted [with respect] to this, namely that all masters beginning in the arts swear that they will dispute no purely theological question..." From Grant, pp. 50-1; translating Buridan, *Physics*, ff. 73v-74r.

[99] f. 113v: "Sic ergo animalia movent seipsa quia in potestate naturali eorum est quiescere ubi sunt vel moveri ad alium locum et moveri ad unam partem vel ad contrariam, quod non est ita de gravibus et levibus <in> animatis. Et hoc est possibile

This might be compared, then, with Pico's exclamation at Vernia's treatment of Averroes's view on celestial movers:

> But this doctor [Vernia] replies as follows: Averroes says that the heaven is moved from within and nevertheless the heaven is not divided [in act into a mover and something moved]. Oh, madness! I reply that Averroes takes the heaven joined with the motor, and the heaven taken in this way is divided into a part moving in act and a part moved in act.[100]

We know, moreover, that the question whether the celestial movers are united to the spheres they move as souls was included in the condemnations of 1277.[101] Was Buridan purposely avoiding controversial and contested points? Surely, he must have known that the conclusion that heavy bodies move themselves was controversial even if hedged around with numerous conditions. I leave it, then, as an open question awaiting confirmation or disconfirmation by future studies of other topics within these commentaries, whether the Parisian nominalists in their Aristotelian commentaries consciously try to avoid theological controversy.

But however this is settled, when all is said and done, it remains that the Parisian nominalists were first and foremost commenting on the text of Aristotle rather than doing natural philosophy pure and simple. They might be more or less willing to say that Aristotle was in error or to interpret him in a way that strained credibility, they might also be more or less interested in finding physically plausible explanations, but however the emphasis fell, nevertheless they continued to tie their discussions to Aristotle's text and its interpretation and to the paedagogic need for completeness in their discussions. Moreover, not only did the Parisian nominalists tie their commentaries to Aristotle's text; they also tied them to other previous commentaries. It is notable that the same principal arguments, the same distinctions, and the same conclusions repeat themselves in Jandun as well as in the Pari-

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hominibus liberum arbitrium habentibus, remanentibus omnibus circumstantiis eisdem, quod non dico ita esse de aliis. Sed de hoc est alibi considerandum."

[100] Pico, f. 10v: "Sed replicat iste doctor sic: Averoys dicit celum ex se moveri et tamen celum non dividitur. O insania respondeo quod Averoys summit celum coniuncto motore et celum sic sumptum dividitur in partem actu moventem et partem actu motam.

[101] See H. Denifle and E. Chatelain, *Chartularium Universitatis Parisiensis*, Paris 1889-97, vol. I, 543-55, e.g. Proposition 92, "That celestial bodies are moved by an internal principle, which is a soul..." Proposition 102, "That the soul of the sky is an intelligence and the celestial orbs are not instruments of the intelligences, but organs..." (translations from Grant, *Source Book*, 49).

sian nominalists. If the dependency of Albert of Saxony and Marsilius of Inghen on Buridan is to be explained by the fact that they were his followers, in some sense, more surprising is the close relation of Buridan to Jandun. Was it expected of commentators that they would deal with a standard set of principal arguments? In future related case studies of how commentary traditions work, it would be important to trace the lineage of principal arguments as well as of conclusions.

Buridan and his followers introduced intrinsic causes to explain both natural motion and projectile motion. By hindsight, the impetus theory of projectile motion seems to represent progress in physics to a greater extent than the explanation of natural motion by heaviness and lightness. But is it clear that Buridan and his followers made the same judgment, i.e., did they judge that their explanation of projectile motion was more successful than their explanation of natural elemental motion? Vernia rejected both theories, while Pico accepted both. If in the eyes of both Vernia and Pico, John of Jandun was identified with the new theory of natural elemental motion, while the Parisian nominalists were associated with the impetus theory of projectile motion, this may be explained by the fact that, to Vernia and Pico, the Parisian nominalists were the innovators concerning impetus theory, whereas John of Jandun was their primary source for the new explanation of what causes heavy bodies to fall. Meanwhile the two innovative theories were evaluated rather similarly. But then why did the Parisian nominalists diverge from Aristotle in both of these ways? Should we, like some previous historians, raise the possibility that these thinkers were moving in a more empirical and less text-bound direction than their predecessors?

What else might Vernia's and Pico's late fifteenth-century surveys of previous opinion on the cause of natural elemental motion tell us about the earlier commentary tradition? If we accept Anneliese Maier's view of the trend over the scholastic period from an earlier emphasis on the generator and remover of the impediment as the cause of natural elemental motion to a later emphasis on the substantial form or the heaviness and lightness, it may be surprising to see Vernia harking back to the earlier view in the sense that he rejects an intrinsic active cause of natural elemental motion. If there had been a consensus about progress in medieval natural philosophy, would we not have expected the later thinkers to agree upon the view that Pico adopted from Jandun? Was Vernia attempting to differentiate himself from the consensus in order to attract the attention of potential patrons? Did those in the Dominican tradition continue to resist this Scotistic innovation? Would the standard reaction have been that of Pico, namely to reassert what may have been by then the consensus view? Was Vernia motivated by a proto-Renaissance effort to return to classical views? After the origin of the theory of elemental natural motion in Scotus's consideration of angelic motion, was there ever again a connection made between theories of angelic and natural elemental motion?

Aside from the historic roots of Jandun's and the Parisian nominalists' explanation of natural elemental motion in Scotus's analysis of the motion of angels, the strongest argument for their view was that a *per se* effect must have a *per se* cause present while it is in process of production. The generator and the remover of the impediments, on this view, were insufficient as causes of natural elemental motion, because they might not even exist as the motion was occurring. If this was a strong motivation for Jandun's theory, then perhaps it is notable that Vernia's innovation in explaining the natural motion of the elements involves giving impetus to the surrounding medium, thus also providing local cause for a local effect, a cause present with the body as it is moved, unlike the generator and the remover of the impediments. Was there a trend over time to requiring concurrent efficient causes?

Here, however, I would also like to return to the "Grant thesis," mentioned at the beginning of my paper, that it was somehow the commentary form with its resultant atomization of thought that held back concerted change in medieval natural philosophy. My first reaction to this thesis is that it does not hold with regard to individual commentators. Buridan, I am convinced, and each of his followers, paid considerable attention to the consistency of their views and how an answer to one question might impact on possible answers to other questions. As this study has shown, the Parisian nominalists were very aware of the ties between one part of Aristotelianism and another, and of which ideas were more fundamental and which less important.

The Grant thesis might be reformulated, however, to concern, not what was the case about any one of the better commentators, but rather how one commentator related to another, particularly how commentators widely separated in space and time interrelated. John Buridan, Albert of Saxony, Marsilius of Inghen, and the other Parisian nominalists were very familiar with each other's ideas and, for the most part, did not try to differentiate one person's opinions from another's. In their commentaries, moreover, they did not highlight those issues on which they thought they were making original contributions, as compared to those issues on which they were giving a standard view. All of these factors would make it difficult for a subsequent commentator to detect where, in fact, they were original. To Vernia and Pico, working more than a hundred years later, the Parisian nominalists' habits of not citing the holders of various opinions by name, of not highlighting their own originality, and of claiming that their views did not contradict Aristotle could be a cause for confusion. The Parisians impressed themselves, however, in the minds of Vernia and Pico as the authors of the impetus theory of projectile motion, so the commentary form and the lack of ascriptions of original opinions was not an insurmountable obstacle to their recognition.[102]

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[102] For a recent more philosophical attempt to attack some of these same questions of the nature of Aristotelianism and its longevity as a tradition, see J. M. M. H. Thijssen, *Some Reflections on the Continuity and Transformation of Aristotelianism in Medieval (and Renaissance) Natural Philosophy*, in: Documenti e Studi sulla Tradizione Filosofica Medievale. Rivista della Società Internazionale per lo Studio del Medioevo Latino, II (1991), 503-28.

Appendix

Parallel texts to the third principal argument of Buridan's Book VIII, Question 4.

Buridan, *Physics, tertia lectura*, Erfurt Ampl. F 298, f. 41r-v: [Third principal argument] "Item in octavo huius dicitur quod omne motum ex se est divisibile in partem per se moventem et partem per se motam, sed animal non est huiusmodi, quia si animal dividatur in animam et corpus et dicatur quod anima est per se movens, non poterit dici quod alia pars sit per se mota, scilicet corpus, quia corpus circumscripta anima non est aliquid in actu et per se motum debet esse aliquid in actu."	Buridan, *Physics, ultima lectura*, Paris 1509, f. 112v: [Third principal argument] "Item in octavo huius dicit Aristoteles omne quod ex se movetur esse divisibile in partem per se moventem et partem per se motam. Sic autem non est animal divisibile, posito quod non sit in animali nisi una forma substantialis, scilicet anima, quia tunc non dividitur animal nisi in animam et in primam materiam. Et si anima moveat per se tamen materia non movetur per se. Hoc apparet per Aristotelem in quinto huius duplici auctoritate. Prima est quod ens in pura potentia non movetur et tale ens est prima materia. Secunda auctoritas est quia quod simpliciter non est hoc aliquid, hoc nullo modo movetur. Et tamen materia non est simpliciter hoc aliquid. Patet ergo quod animal non est divisibile in partem per se moventem et partem per se motam.
"Et si dicatur quod corpus circumscripta anima adhuc est in actu accidentali per sua accidentia, istud non valet quia sic diceremus de gravi inanimato, scilicet quod sit divisibile in partem per se moventem que est forma gravitatis et partem per se motam existentem in actu que est materia accidentibus actuata, quod tamen negant Aristoteles et Commentator."	Et ultra si diceretur animal est divisibile in partem per se moventem et partem per se motam, dicendo quod anima movet per se et materia movetur per se, ita diceremus quod grave inanimatum in huiusmodi partes divideretur, quia dicit Commentator in quarto huius quod in motu ipsius gravis forma est motor et materia est mota. Ergo si ob hoc animal diceretur moveri ex se ita oporteret dicere quod grave inanimatum moveretur ex se quod negat Aristoteles."
f. 41v: [Reply to the third principal argument] "Et rationes que fiebant non procedunt contra dicta. Conceditur enim bene quod animal movetur ab aliquo alio, quia vel ab anima vel a continente, tamen potest moveri et incipere motum suum sine hoc quod tunc indigeatur motore	f. 113v: [Reply to the principal arguments] "Rationes autem ad utramque partem que fiebant in principio questionis non procedunt contra determinata, etc."

extrinseco. Et ad talem sensum conceditur moveri ex se. Et quando dicitur quod omne motum ex se est divisibile in partem per se moventem et partem per se motam, dico quod Aristoteles intendebat quod illa pars per se mota est sic in actu quod per illum actum resisteret motori et ita grave inanimatum circumscripta forma sive gravitate circummovente[103] non est in actu sed animal circumscripta anima movente adhuc esset dicto modo in actu. Corpus enim per suam gravitatem resistit anime moventi. Et hanc differentiam intendit Aristoteles in Octavo huius inter animal et grave inanimatum."	
Albert of Saxony(?), *Physics*, Cesena, Malatestiana, S. VIII.5, f. 69ra: [Third principal argument] "Tertio nam per Aristotelem in isto octavo omne motum ex se est divisibile in partem per se moventem et in partem per se motam, modo sic non est de animali. Ergo animal non movetur ex se. Assumptum probatur, quia animal est divisibile in corpus et animam, modo corpus circumscripta anima non est per se motum propter hoc quod istud quod debet esse per se motum debet esse ens actu per aliquem formam. Et si dicatur quod licet non sit in actu per aliquam formam substantialem circumscripta anima, adhuc tamen est in actu per formam accidentalem et hoc sufficit. Sed contra si hoc sufficeret tunc grave inanimatum posset dici motum ex se quod Aristoteles negat in isto octavo. Probatur consequentia ex eo quod grave inanimatum est divisibile in partem per se moventem, scilicet eius formam, et aliam partem motam, que adhuc est in actu per aliquam formam circumscripta eius forma per se movente."	Albert of Saxony, *Physics*, Paris 1518, f. 79v: [Third principal argument] "Tertio nam per Aristotelem in isto octavo, omne motum est divisibile in partem per se moventem et in partem per se motam, modo sic non est de animali. Ergo animal non movetur ex se. Antecedens probatur. Animal est divisibile in corpus et animam, modo corpus circumscripta anima non est per se motum, propter hoc quod illud quod debet esse per se motum debet esse ens in actu per aliquam formam, modo circumscripta anima non videtur quod sit corpus in actu per aliquam formam. Et si dicatur quod licet non sit in actu per aliquam formam substantialem circumscripta anima, adhuc tamen est in actu per aliquam formam accidentalem et hoc sufficit. Sed contra, si hoc sufficeret, tunc grave inanimatum diceretur vel posset dici moveri ex se, quod Aristoteles negat in isto octavo. Probatur consequentia ex eo quod grave inanimatum est divisibile in partem per se moventem, scilicet eius formam, et in aliam partem motam, que adhuc est in actu per aliquam formam accidentalem circumscripta eius forma per se movente."
f. 69rb: [Reply to the third principal argument] "Ad tertiam concedo quod	ff. 79v-80r: [Reply to the third principal argument] "Ad tertiam concedo

animal dividitur in partem per se moventem et in partem per se motam et sic nego minorem. Et quando arguitur circumscripta anima residuum non est per se motum propter hoc quod non est ens in actu, nego. Probo: sufficit quod sit ens in actu per quem actum resistat moventi et ita est de corpore animalis anima circumscripta, quia adhuc corpus est in actu per istam gravitatem per quam quidem gravitatem resistit anime moventi. Sed sic non est de gravi inanimato. Licet enim forma circumscripta adhuc residuum maneat in actu per gravitatem, tamen per illam non resistit moventi, scilicet forme substantiali gravis, et ideo grave non dicitur moveri ex se sed animal bene."

quod animal est divisibile in partem per se moventem et in partem per se motam et sic nego minorem. Et quum arguebatur circumscripta anima residuum non est per se motum propter hoc quod non est ens in actu, nego. Immo sufficit quod sit ens in actu propter quem actum resistit moventi et ita est de corpore animalis circumscripta anima, quia adhuc corpus est in actu per gravitatem, per quam quidem gravitatem resistit anime moventi. Sed sic non est de gravi inanimato, sed forma eius substantiali circumscripta adhuc residuum manet in actu per gravitatem, tamen per illam non resistit moventi, scilicet forme substantiali gravis, et ideo grave non dicitur moveri ex se, sed animal bene."

Parallel texts from earlier commentaries:

Averroes, in *Aristotelis De Physico Auditu Libri Octo. Cum Averrois Cordubensis variis in eodem Commentariis.* vol. 4, Venice 1562, Book 8, comment 30, f. 367v: "Si igitur aliquis dixerit quod sunt corpora simplicia composita ex materia et forma, quorum utrumque est distinctum secundum definitionem a reliquo, dicemus ad hoc quod prima materia non est existens in actu. Et illud quod movetur ex se debet dividi in motorem et motum in actu, quoniam illud quod est in potentia neque movetur neque movet. Si igitur lapis, verbi gratia, moveretur ex se, contingeret ut esset movens et motum eodem modo secundum formam, quoniam non est existens in actu nisi secundum formam, quod est impossibile.... Deinde dicit: *Secundum igitur quod est continuum, etc.* id est quod res continue, secundum quod sunt continue non contigue impossibile est ut recipiant passionem, id est motum ex se, cum non dividantur in motorem et motum nisi essent continue copulate secundum contiguitatem. Et dicit hoc quia illud quod movetur ex se aut erit divisibile secundum definitionem aut secundum quantitatem, id est partes, et cum corpora

John of Jandun, *Super Octo Libros Aristotelis de Physico Auditu Subtilissimae Quaestiones*, Venice 1551, reprint Frankfurt 1969, Book 8, Question 11, f. 115r: "[Second principal argument] Item, illud quod dividitur in partem moventem et partem motam movet seipsum, ut patet in isto Octavo. Sed grave inanimatum est huiusmodi. Dividitur enim in materiam et formam, et forma est movens et materia res mota, ut dicitur Commentator in Quarto huius. Et si dicas ad hoc quod materia gravis non potest esse illud quod per se movetur deorsum, quia quod movetur debet esse ens actu, et ipsa materia gravis non debet esse ens actu, contra hoc est quia animal dicitur movere seipsum eo quod dividitur in corpus et in animam, quod est pars animalis distincta contra animam, et non est aliquod ens distinctum praeter animam ut communiter dicitur, ergo similiter in proposito, quamvis materia quae est pars lapidis non sit ens actu preter formam eius substantialem, poterit tamen esse per se mota, sicut anima est per se movens non obstante quod ipsa sit actus. Sic forma lapidis poterit esse per se movens ut videtur."

simplicia non dividantur altero modorum istorum, sequitur quod non moveantur ex se omnino.... Et iste sermo sic componitur: Corpora naturalia sunt consimilium partium simplicium, et illa que sunt consimilium partium simplicium impossibile est ut moveant se, ergo corpora naturalia non moveant se.''

Aegidius Romanus, *Commentaria in octo libros phisicorum Aristotelis*, Venice 1502, 192v: ''Quarta vero ratio innititur huic fundamento quod omne quod movetur ex se habet partes diversarum rationum, quia est divisibile in movens et motum que secundum quod huiusmodi in unam rationem non coincidunt. Corpus ergo simplex si dividitur in plures partes vel hoc erit in plures partes essentiales ut in materiam et formam, vel in plures partes quantitativas.... Si igitur talia corpora seipsa movent et sunt divisibilia in plures partes quarum una est per se movens et alia per se mota, vel hoc erit quia forma ibi erit per se movens et materia per se mota, vel quia una pars quantitativa erit ibi per se movens et alia per se mota. Primus autem modus stare non potest, quia materia non potest habere rationem per se motam, cum dicat quod omnino in potentia nec secundum quod huiusmodi habeat aliquid per quod possit resistere moventi.... Philosophus ergo premittit hunc modum quod corpora simplicia non moveant seipsa quasi forma moveat materiam cum quasi per se notum sit materiam non posse esse illud quod per se movetur cum mobile et motum non dicat potentiam puram sed dicat potentiam admixtam actui. Cum enim ipse motus sit quidam actus, impossibile est quod movetur non esse quodammodo in actu.''

f. 115rb-va: [Excerpt from determination of the question] ''Si autem quaeritur de motu gravis in actu, prout ad ipsum est potentia accidentalis, verbi gratia, cum lapis est sursum et remoto prohibente descendit deorsum, utrum tunc ipsum grave moveat seipsum, de hoc est magna difficultas et diversitas inter doctores. Et dicunt plurimi et quasi omnes quod huiusmodi grave secundum actum existens in potentia accidentali ad ubi deorsum non movet seipsum per se, sed solum per accidens. Quod probant. Si moveret seipsum per se, tunc oporteret quod esset divisibile per se et in partem per se moventem et in partem per se motam secundum Aristotelem in isto Octavo. Hoc autem est impossibile, sicut patet in litera. Nam illae partes aut essent partes quantitativae ipsius gravis, aut partes essentiales, per sufficientem divisionem. Non partes quantitativae, quia partes quantitativae et secundum qualitatem sunt unius dispositionis et virtutis. Unde nulla est ratio quare una esset movens per se et alia per se mota. Nec partes essentiales, quia omnes partes essentiales sunt forma et materia prima. Materia autem prima non potest esse per se mota, cum sit ens in pura potentia et nullam resistentiam habet ad movens. Semper enim debet esse resistentia, ut accipit Commentator Quarto huius. Ergo ipsum grave non movet seipsum per se.'' 118vb: [Reply to principal arguments] ''At rationes in principio quaestionis adductae non concludunt contra hanc positionem, sed quod defectus sit in eis patet diligenter inspicienti praedicta.''

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[103] The reading ''circummovente'' seems clear from the manuscript, but ''circum'' is probably an error.

Vivarium XXXI, 1 (1993) ©E.J. Brill, Leiden

Jean Buridan and Nicole Oresme on Natural Knowledge

EDWARD GRANT

Any list of "most notable intellects" among scholastic authors in the Middle Ages would undoubtedly include two fourteenth-century Frenchmen, Jean Buridan (1300-before 1361) and Nicole Oresme (ca. 1325-1382). Ever since Pierre Duhem first drew attention to their varied and weighty contributions to medieval science, they have been the focus of considerable attention.[1] A brief comparison of their status, works and influence is instructive. Oresme was both a natural philosopher and theologian, while Buridan's professional expertise was confined to natural philosophy which he practiced for many years as a Master of Arts in the Faculty of Arts at the University of Paris.[2] As a Master of Arts, Buridan commented almost exclusively on the works of Aristotle, leaving behind a commentary or *questiones* on almost all of the latter's treatises and some that were falsely attributed to him.[3] Oresme's legacy is quite different. Not only did he comment on at least six of Aristotle's treatises (the *Physics, On Generation and Corruption, On the Soul, On the Heavens*, the *Meteorology*, and *Small Natural Treatises (Parva naturalia)*,[4] but he wrote nearly twice as many tractates on a wide range of topics. Apart from his *Le Livre du ciel et du monde*, his French commentary on Aristotle's *De caelo*, Oresme's most innovative and original treatise took the form of tractates (*Tractatus*) on themes that are largely independent of the traditional question format. Included in his impressive list of thematic treatises are: *De proportionibus proportionum, Ad pauca respicientes, Tractatus de configurationibus qualitatum et motuum, Questiones super geometriam Euclidis, Tractatus de commensurabilitate vel incommensurabilitate motuum celi, Algorismus proportionum, Tractatus de spera, Tractatus de mutationibus monetarum* and a series of works against magic and astrology, namely *De causis mirabilium* (also known as the *Quodlibeta*), *Questio contra divinatores, Tractatus contra judiciarios astronomos*, and *Livre de divinacions*. It is in this impressive list of thematic tractates, rather than in his scholastic *questiones* on the works of Aristotle, that Oresme displays his most original and creative ideas. In these treatises the ordinary constraints of scholastic discourse could be ignored and avoided, replaced by a much freer play of the imagination.[5]

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[1] See P. Duhem, *Le système du monde, histoire des doctrines cosmologiques de Platon à Copernic*, 10 vols., Paris 1913-1959 and *Études sur Léonard de Vinci, ceux qu'il a lus et ceux qui l'ont lu*, 3 vols., Paris 1906-1913.

[2] The possible significance of this major difference will be considered below.

[3] For a list of the manuscripts and editions of Buridan's works, see C. H. Lohr, *Medieval Latin Aristotle Commentaries, Authors: Jacobus-Johannes Juff*, in: Traditio, 26 (1970), 161-83.

[4] Indeed he even translated four of Aristotle's treatises (*On the Heaven, Politics, Ethics*, and *Economics*) from Latin into French for King Charles V. These translations were accompanied by French commentaries. For a list of manuscripts and editions of his Aristotelian treatises, see C. H. Lohr, *Medieval Latin Aristotle Commentaries, Authors: Narcissus-Richardus*, in: Traditio, 28 (1972), 290-8.

In 1978, I published an article in which I compared the approaches to science of these two luminaries.[6] Although I retain much of what I said then, new research and studies on both have enabled me to see deeper and further than was then possible. In this study, I shall integrate what seems worth preserving from my earlier article with the new insights that have been made possible by subsequent research. I shall first describe Buridan's view of science and, using that as a base, show in what sense Oresme differed. In what follows, we should at least be alert to the possibility that some of the differences between Buridan and Oresme may derive from a disciplinary struggle that went on through the Middle Ages between natural philosophy (philosophy in the broadest sense) and theology.[7] As a Master of Arts, who devoted his professional life to the study of Aristotelian natural philosophy and who had had no training in theology, Buridan stands in contrast to Nicole Oresme who possessed not only a master of arts degree from the University of Paris, but also acquired a doctorate in theology, probably by 1356. Although both may properly be characterized as Aristotelians, their attitudes toward knowledge differed considerably, if not radically, as we shall see below.

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[5] By Oresme's day, the *questiones* tradition was deeply rooted for each of Aristotle's treatises on which *questiones* were written. Although new questions could be introduced and old ones omitted or bypassed, most authors tended to include many, if not most, of the same questions and range of responses as their contemporaries and immediate predecessors. New concepts and thoughts were more easily introduced into treatises that were not based on an authoritative text. Indeed, even commentaries on the works of Aristotle seem to have offered more opportunities for novelty than *questiones*. This is evident in the greater novelty and depth of Oresme's French commentary on Aristotle's *De caelo*, as opposed to his *Questiones* on *De caelo*. If so inclined, one could incorporate almost any themes into different parts of a commentary, something that was not very feasible in an ordinary *questiones*.

[6] *Scientific Thought in Fourteenth-Century Paris: Jean Buridan and Nicole Oresme*, in: *Machaut's World: Science and Art in the Fourteenth Century*, eds. M. P. Cosman and B. Chandler, New York 1978, 105-24 (Annals of the New York Academy of Sciences, vol. 314).

[7] For a good account of this disciplinary struggle, see D. A. Iorio, *The Aristotelians of Renaissance Italy. A Philosophical Exposition*, Lewiston, N.Y. 1991, chs. 1-4.

1. Jean Buridan

Jean Buridan was perhaps the quintessential empiricist of the Middle Ages. He had an abiding faith in human ability to understand and describe the operations of nature in terms of cause and effect based ultimately on sense perception. During the Middle Ages, however, such convictions had inevitably to be reconciled with faith. Insofar as can be determined, Buridan had no overt problems with his faith. He accepted the truths of revelation as absolute and frequently acknowledged that God could do anything that was considered "naturally impossible",[8] which often meant the kinds of natural impossibilities, or "thought experiments," that had become fashionable as a result of the Condemnation of 1277.[9] Buridan was not much attracted to the physics and cosmology of "what God might have done." Indeed, God's uncontested power to do these things, ought not to imply that He had done so, or would do so. Thus, while Buridan was prepared to concede that "we hold on faith that just as God made this world, so could he make another, or others,"[10] he thought it far more plausible to believe that if God chose to create more creatures of the kind that appear in our world, He would simply increase its size by any factor He pleased rather than create other worlds.[11] With equal plausibility, God could create a finite or infinite space beyond the limits of our world, but we have no warrant to believe that He had done so, since the accessible sources of evidence, namely sense experience, natural reason, and the authority of Sacred Scripture, fail to indicate the existence of such a space beyond our world.[12]

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[8] See A. Maier, *Das Prinzip der doppelten Wahrheit*, in: A. Maier, *Metaphysische Hintergründe der spätscholastischen Naturphilosophie*, Rome 1955, 27.

[9] For illustrations, see Edward Grant, *The Condemnation of 1277, God's Absolute Power, and Physical Thought in the late Middle Ages*, in: Viator, 10 (1979), 211-44.

[10] Buridan's discussion occurs in his *Questions on the Physics*, bk. 3, qu. 15 in: *Acutissimi philosophi magistri Johannis Buridani subtilissime questiones super octo Phisicorum libros Aristotelis diligenter recognite et revise magistro Johanne Dullaert de Gandavo antea nusquam impresse*, Paris 1509; reprinted in facsimile under the title *Johannes Buridanus, Kommentar zur Aristotelischen Physik*, Frankfurt a.M. 1964, fol. 57v, col. 2; also quoted in Grant, *Scientific Thought in Fourteenth-Century Paris*, 119, n. 19.

Although Buridan sought as much as possible to exclude God from the deliberations of natural philosophy, the two were often unavoidably intertwined, as was obvious from the Condemnation of 1277 with its numerous articles condemning the eternity of the world and the denial of absolute powers to God in the execution of natural impossibilities. ''It was a common doctrine in the thirteenth and fourteenth centuries,'' declares J. M. M. H. Thijssen, ''that *agentia naturalia* operate with necessity, but that their effects may be prevented. With such agents,'' he continues, ''it is not contradictory to say that the cause exists and the effect does not because the latter might have been impeded *per accidens* by some other cause or because God has miraculously intervened in nature.''[13] Indeed God might not only intervene miraculously in some spectacular manner—as, for example, to make fire cold—but He might also substitute His own direct causality for that of the secondary causality of a natural agent. For example, He might choose to make fire hot directly, thus replacing the natural agent. If so, we would be unable to determine whether any effect was produced naturally or supernaturally. Truth in natural science would thus be impossible.

In his response to this dilemma, Buridan followed a tradition that had already been underway. In his *Questions on the Metaphysics*, bk. 2, qu. 1, Buridan asks ''whether the grasp of truth is possible for us.''[14]

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[11] For the text, see Buridan's *Questions on De caelo*, bk. 1, qu. 18 in: *Johannis Buridani Quaestiones super libris quattuor De caelo et mundo*, ed. E. A. Moody, Cambridge, Mass. 1942, 84, 89. The relevant passage on p. 84 is quoted in Grant, *Scientific Thought in Fourteenth-Century Paris*, 119, n. 18.

[12] For the Latin text, see Buridan's *Questions on De caelo*, bk. 1, qu. 17, in Moody's edition, p. 79; the text is also cited in Grant, *Scientific Thought in Fourteenth-Century Paris*, 119, n. 20.

[13] J. M. M. H. Thijssen, *John Buridan and Nicholas of Autrecourt on Causality and Induction*, in: Traditio, 43 (1987), 240.

[14] ''Queritur circa secundum librum utrum de rebus sit nobis possibilis comprehensio veritatis.'' *In Metaphysicen Aristotelis; Questiones argutissime Magistri Ioannis Buridani in ultima praelectione ab ipso recognitae et emissae ac ad archetypon diligenter repositae cum duplice indicio materiarum videlicet in fronte et quaestionum in operis calce*, Paris 1518, fol. 8r, col. 1.

With regard to natural science, Buridan insists that we can attain truth with certainty by taking evidence "*secundum quid* or *ex suppositione*," which occurs when "a common course of nature (*communis cursus nature*) is observed in things and in this way it is evident to us that all fire is warm and that the heaven moves, although the contrary is possible by God's power."[15] In this statement, Buridan expresses the medieval doctrine of reasoning *ex suppositione*, in a form similar to that assumed earlier by Thomas Aquinas and described by William Wallace as a "*suppositio* [or assumption] of the order of nature unimpeded by external causes, such as chance occurrences within nature itself or God's miraculous intervention."[16] The "certain" truths Buridan had in mind are indemonstrable principles which are the basis of natural science, as he makes clear in his examples that all fire is warm and that the heaven moves. These principles need not be absolute but can be derived by inductive generalization—that is, as Buridan puts it, "they are accepted because they have been observed to be true in many instances, and to be false in none."[17] Absolute evidence is not required. These indemonstrable, inductively generalized principles are conditional because their truth is predicated on the assumption of the "common course of nature." Since Buridan's methodology of science is based on the "common course of nature," God's possible intervention in the causal order now becomes irrelevant. Although Buridan readily conceded that God could alter the natural course of events at any time, he nevertheless insisted that "in natural philosophy, we ought to accept actions and dependencies as if they always proceed in a natural way."[18] The occurrence of miracles would not affect the validity of natural science. Nor indeed would chance occurrences that might occasionally impede or prevent the natural effect of a natural cause. For as Hansen has rightly observed, "Phenomena regarded as natural in the Middle Ages were only those which occur most of the time, in nature's 'habit' or usual course. The law of nature within the Aristotelian conceptual framework was not one of rigid necessity, but simply that of the usual or ordinary occurrence. *Habitus* and *inclinatio* are common medieval expressions for this tendency."[19] Just because individuals are occasionally born with eleven fingers does not negate the fact that in the common course of nature we can confidently expect ten fingers.[20] On this basis, Buridan could proclaim that "for us the comprehension of truth with certitude is possible."[21] Using reason, experience and inductive generalizations, Buridan sought to "save the phenomena" in accordance with the principle of Ockham's razor—that is, by the simplest explanation which fits the evidence.

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[15] "Sed alio modo accipitur evidentia secundum quid sive ex suppositione, ut prius dicebatur, quod observaretur in entibus communis cursus nature et sic esset nobis evidentia quod omnis ignis est calidus et quod celum movetur, licet contrarium sit possible per potentiam Dei." Buridan, *In Metaphysicen Aristotelis*, bk. 2, qu. 1, fols. 8v, col. 2-9r, col. 1. The translation is by Edith Sylla, *Galileo and Probable Arguments*, in: *Nature and Scientific Method*, ed. D. O. Dahlstrom, Washington, D.C. 1991, 216 (Studies in Philosophy and the History of Philosophy, vol. 22).

[16] See W. A. Wallace. *Aristotle and Galileo: The use of ὑπόθεσις (Suppositio) in Scientific Reasoning*, in: *Studies in Aristotle*, ed. D. J. O'Meara, Washington, D.C. 1982, 64.

[17] The translation is by E. A. Moody in his article *Buridan, Jean*, in: *Dictionary of Scientific Biography*, ed. Charles G. Gillispie, vol. 2 (1970), 605. Moody's translation converts the following Latin text: "Imo solum conceduntur quia sicut vidimus in pluribus singularibus et in nullis potuimus invenire instantiam." Although I believe Moody has caught the spirit of the argument, which I shall follow, his version of "et in nullis potuimus invenire instantiam" does not seem right. The term "instantiam" must somehow represent the sense of "counterinstance." The text is from Buridan's *Questions on the Metaphysics*, bk. 2, qu. 2, in *In Metaphysicen Aristotelis*, fol. 9v, col. 2, where Buridan explains that "These principles are not immediately evident; indeed we may be in doubt concerning them for a long time. But they are called principles because they are indemonstrable, and cannot be deduced from other premises nor be proved by any formal procedure; but they are accepted because they have been observed to be true in many instances and to be false in none." (Moody, ibid., 604-5).

A good example of Buridan's use of the principle of economy to save the appearances occurs in his *Questions on De caelo*, bk. 1, qu. 11, "whether the heaven has matter." In denying that the celestial region contains matter, Buridan observes that substantial transmutation was the only way Aristotle had for determining whether celestial bodies possessed matter. The essential feature of a substantial transformation, which we can all observe, is that the generated thing and the corrupted thing had the same subject. This was a necessary assumption since it was axiomatic for Aristotle that something could not be made from nothing. Buridan now juxtaposes two common, basic assumptions: the first that the heavens are incorruptible—that is, neither generable nor corruptible—and the second that matter is something that is generable and corruptible. From these two assumptions, Buridan easily concluded that it would be "absolutely in vain, and without cogent reason, that we should posit such matter in the heavens."

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[18] "Modo in naturali philosophia nos debemus actiones et dependentias accipere ac si semper procederent modo naturali; ..." *Questions on De caelo*, bk. 2, qu. 9; p. 164 in Moody's edition. Maier also cites these lines in *Metaphysische Hintergründe*, 18 and 328, n. 22.

[19] Hansen, *Nicole Oresme and the Marvels of Nature*, 63 (for full title, see below, n. 25).

[20] I rely here on Thijssen, *John Buridan and Nicholas of Autrecourt*, 251.

[21] "Immo concludendum est quod querebatur, scilicet quod nobis est possibilis comprehensio veritatis cum certitudine." Buridan, *Questions on the Metaphysics*, bk. 2, qu. 1, in *In Metaphysicen Aristotelis*, fol. 9r, col. 1.

Other explanations for this problem had been proposed. Thomas Aquinas, Buridan reports, argued that the heaven did indeed possess matter, but it was simply different than the matter that appears in the inferior, or sublunar world. Buridan concedes that it is difficult to demonstrate the contrary of Thomas' interpretation. But the solution lies at hand by appeal to the principle of simplicity, namely "that in nature nothing ought to be assumed in vain," a sentiment that Buridan attributes to Averroes.[22] But, as Buridan explains, it is vain to save appearances by the assumption of more things when those appearances could be saved by fewer things.[23]

In agreeing with Aristotle that something could not be generated from nothing, Buridan was well aware that this conflicted with the Catholic faith. God could indeed create something from nothing supernaturally, as when He created the world. But in natural philosophy one ought to adopt principles that reflect the "common course of nature." That something could not be made or generated from nothing was one of the most basic of such natural principles. Thus when arguing about a problem in natural philosophy that was independent of the faith, and which did not directly impinge on dogma or theology, it was appropriate to assume the "common course of nature" and therefore to assume as true the principle that "something cannot come from nothing."

Before we conclude our brief summary of Buridan's ideas, we must say something about his sense of inductive generalization based on the statement quoted earlier that natural principles need not be absolute if "they have been observed to be true in many instances (*in pluribus singularibus*) and to be false in none." Could we formulate an indemonstrable natural principle from one or two positive instances and no counterinstances? The answer has to be yes. The addition of further positive instances only deepens our confidence in the principle, as Buridan indicates when he declares that "These principles are not immediately evident; indeed," he continues, "we may be in doubt concerning them for a long time" (see note 17). Obviously, the more positive instances we have, the more confident we can be that the counterinstance will not occur. But the principle is as serviceable with one or two instances as with two hundred, or two thousand.

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[22] "Et esset difficile demonstrare oppositum, nisi sicut Commentator tangit, quod in natura nihil debet poni frustra." Buridan, *Questions on De caelo*, bk. 1, qu. 11 (p. 52 in Moody's edition). According to Moody, Averroes, the Commentator, mentions, in his commentary on *De caelo*, bk. 1, comment 20, that nature does nothing in vain. While this is probably the correct reference, Averroes does not actually enunciate the principle, but rests content to declare that if the substance of matter is in potentiality to that matter and never comes to actuality, "this potentiality is vain and superfluous." In the edition of *Aristotelis Opera cum Averrois commentariis*, Venice 1562-1574, see vol. 5, fol. 15r, col. 2.

[23] Following immediately after the Latin quotation in n. 22 from Buridan's *De caelo*, bk. 1, qu. 11 (p. 52 of Moody's edition), we read: "Et tamen frustra ponuntur plura quia omnia apparentia possent salvari per pauciora."

Buridan's elevation of inductive generalizations to the level of indemonstrable natural principles that furnish all the certitude necessary for science must also be viewed as part of a long disciplinary struggle between philosophy and theology, which was also an intellectual conflict between reason and revelation. It began in the thirteenth century, when its foremost protagonists were Siger of Brabant and Boethius of Dacia in defense of philosophy, and St. Bonaventure and Etienne Tempier, the Bishop of Paris, and numerous others on the side of theology. Jean Buridan may legitimately be viewed as one more powerful voice seeking to develop a natural philosophy with principles and a methodology that was independent of theology and of God's absolute and unpredictable power. Italian Renaissance philosophers, such as Pietro Pomponazzi, Giacomo Zabarella, Giacomo Aconcio, and Marcantonio Zimara, continued the struggle. Dominick Iorio has characterized the tendencies of these secular philosophers as *philosophical reductionism*, whose advocates were convinced that "all truth that lends itself to rational demonstration falls into the province of philosophy and not of theology" from which they concluded that articles of faith "which could not pass the test of reason were to be either rephrased along rational lines or omitted altogether from the philosophical enterprise and left to the realm of 'faith'."[24]

2. *Nicole Oresme*

As a natural philosopher-theologian, Nicole Oresme held a more complex view of nature than did Buridan. On certain basic matters, however, he seems to have been in agreement with Buridan, who some believe was his teacher. For example, although he does not explicitly pronounce his acceptance of the argument *ex suppositione*, Oresme seems to have shared Buridan's acceptance of it. Barring God's intervention or some impediment in nature, a particular natural cause would always produce its regular, natural effect. But Oresme went much further and launched a vigorous attack against those who were quick to invoke magical and supernatural explanations for what seemed to him natural phenomena. In a treatise titled *De causis mirabilium* (or *On the Causes of Marvels*), dated in 1370 and therefore probably one of his later works,[25] Oresme, at the outset of his treatise, explains his intention "to show the causes of some effects which seem to be marvels and to show that the effects occur naturally, as do others at which we do not marvel." To reinforce his position, Oresme goes on to say that "There is no reason to take recourse to the heavens, the last refuge of the weak, or demons, or to our glorious God as if He would produce these effects directly, more so than those effects whose causes we believe are well known to us."[26] Throughout his *Quodlibeta* and other works before and after, Oresme attacked superstition in its many forms. As Thorndike has explained:

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[24] See Iorio, *The Aristotelians of Renaissance Italy*, 18.

> Although Oresme admits the existence of demons as a matter of religious faith and accepts the miracles of the Bible, he does not hesitate to censure certain ecclesiastical frauds and certain superstitious practices which have developed in connection with the exercise of Christian worship. Not only does he accuse many clerics of excessive credulity, he flatly charges that many ecclesiastics have devised fraudulent miracles to secure offerings for their churches...[27]

Despite Oresme's firm belief that natural causes are far more probable to explain the effects we detect in nature than are supernatural and magical causes, he seems to have lacked Buridan's confidence in detecting them. In the second paragraph of *De causis mirabilium*, Oresme insists that it is very difficult (*quod est difficillimum*) to assign particular causes for particular effects. How can we explain "why an animal died at such a time, why pepper in small quantities is a laxative and a diuretic in large quantities, why scammony is the opposite (as Aristotle says in the first part of the *Problems*), why the crop failed in this field," and so on.[28] To avoid these difficulties, Oresme says that "it will suffice for me to show that the things mentioned occur naturally."

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[25] The *De causis mirabilium* is the second part of a work by Oresme that comprises four distinct parts which have usually been given the overall title of *Quodlibeta*. The first part, title *Questio contra divinatores horoscopios*, has been edited by Stefano Caroti in: Archives d'histoire doctrinale et littéraire du moyen age, 43 (1976), 201-310. The second part is the *De causis mirabilium*, which is not Oresme's title but one given to it around 1500. It has been edited and translated by Bert Hansen with the title *Nicole Oresme and the Marvels of Nature, A Study of His "De causis mirabilium". Critical Edition, Translation, and Commentary*, Toronto 1985. The third part, cited usually as *Tabula problematum* consists of 216 questions, which are little more than a listing of the titles of 216 questions. The fourth part, arbitrarily titled *Solutiones probleumatum*, is a detailed discussion of the first 44 questions of the *Tabula problematum.* For a discussion of the four parts, see Hansen, ibid., 26-43; for the date of composition, see 43-8.

[26] Oresme, *De causis mirabilium*, Prologue, in Hansen, ibid., 137.

[27] Lynn Thorndike, *A History of Magic and Experimental Science*, 8 vols., New York 1923-1958, vol. 3, 467-8.

Both Buridan and Oresme were convinced that, barring supernatural intervention, natural causal explanations were appropriate for all phenomena. But where Oresme stressed the almost insurmountable difficulties in determining such causes, Buridan seems to have ignored the difficulties. Oresme was content to argue that the kinds of effects we have just described were caused naturally, but admitted that the determination of the specific natural cause was very difficult or even unattainable. It is as if he concluded that each effect was in some sense different from every other effect. Indeed, Oresme seems to have believed that compounds differ sufficiently from the elements out of which they are composed and that these compounds, in turn, differ so much from one another that, in the words of Lynn Thorndike, "many and all phenomena of nature are really just as inexplicable as the action of the magnet."[29] In such a world, Oresme believed it more plausible to assume that effects were the product of natural causes. He thought it sufficient to show that natural causes were more likely to produce nature's effects than magic or the supernatural.

One may properly doubt, therefore, that Oresme would have derived natural principles from inductive generalizations of two or more similar instances, in the manner of Buridan. Where Buridan emphasized the simplicity of science and its essential knowability, Oresme emphasized its complexity and difficulties. Although Oresme may have allowed and encouraged "a search for causal knowledge of the world,"[30] he would probably have doubted the likelihood of its success and would have disagreed with Buridan that such causal knowledge could be fashioned into suitable inductive generalizations from which indemonstrable natural principles could be formed.

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[28] Oresme, *De causis mirabilium* in: *Nicole Oresme and the Marvels of Nature*, ed. and tr. Hansen, 137.

[29] Thorndike, *A History of Magic*, vol. 3, 441.

[30] See Hansen, *Nicole Oresme and the Marvels of Nature*, 101.

If Oresme was a dedicated opponent of superstition and hostile to those who invoked marvelous causes for effects found in nature, what was his attitude toward natural knowledge? Did he believe that such knowledge was readily attainable, that our senses could serve as the basic instrument for determining natural causes? Available evidence indicates that Oresme was sceptical about human ability to determine the causes of natural effects. In the *Ad pauca respicientes*, he assumed that we were ignorant of all celestial ratios in which the distances or times of any two celestial bodies varied. We must assume this Oresme insists, because "it is well understood that we cannot even know about quantities close by because of [our] defective senses."[31]

In the fourth and final part of his *Quodlibeta*, Oresme twice expresses Socratic doubt about his ability to attain natural knowledge. In the first of these unusual passages, Oresme emphasizes that many things in the Gospels and in the articles of faith are no less reasonable than are many things in philosophy. Indeed all things mentioned in the Gospels are very reasonable. For although the faith assumes miracles, as, for example, the Trinity, penetration of bodies, and the Resurrection, "it seems to me," says Oresme, "that many things equally miraculous are assumed in philosophy and are [even] less demonstrated because they are customary [or familiar], as [for example], what is prime matter, and [how] the production of a new form [occurs] of which at first nothing exists, and concerning accidents, which are things, and how they exist simultaneously, and concerning the indivisible soul; [and] indeed, how fire heats [or burns] and what is the nature and quiddity of things...and why does a stone descend downward and yet sometimes ascends upward naturally to prevent the occurrence of a vacuum? What, therefore, moves it upwards?" In light of this list of natural phenomena, "surely," Oresme declares, in drawing this extraordinary paragraph to a close, "if you consider the matter properly, [you will realize that] many such [natural] things are unknown, more [unknown] than many articles of the faith. And therefore, indeed, I know nothing except that I know that I know nothing."[32] And later in the same treatise, again in reference to natural knowledge, Oresme found occasion to assert that "extraordinary difficulties arise here about the modes and species of operations and about the number of qualities and their differences; ...and although they [i.e. these difficulties] appear easy to many, they seem difficult to me. Therefore I know nothing except that I know that I know nothing."[33]

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[31] See *Nicole Oresme: 'De proportionibus proportionum' and 'Ad pauca respicientes'*, ed. and tr. E. Grant, Madison, Wis. 1966, 387 (*suppositio tertia*). I have added the bracketed word to my previous translation.

Was Oresme's confession of ignorance, the act of a humble scholar who recognized his own severe limitations? Or, was it rather the assertion of a powerful, and perhaps even arrogant, theologian who sought to humble and subvert confidence in natural knowledge in the hope of leaving the realm of faith alone unscathed? I judge the latter interpretation the more plausible in rendering intelligible Oresme's complex approach to nature and faith.

3. "To Believe Easily" and Oresme's Double Agenda

In his *Quodlibeta*, Nicole Oresme makes this extraordinary statement:

> It seems to me to believe easily (*faciliter credere*) is and has been the cause of the destruction of natural philosophy; and also in faith it makes and will make great dangers and it will be the cause of receiving Antichrist and of the introduction of a new law.[34]

Whatever the meaning of this extraordinary assertion, which may never be fully known, we can be certain of Oresme's conviction that people in general, and scholars in particular, were all too ready and eager, on the slightest pretext, to believe all sorts of things relevant to natural philosophy and the faith. Because so many of these beliefs were erroneous or ill-supported, they were potentially dangerous to the faith. To understand Oresme's attitude in the *Quodlibeta*, written late in his career but which may reflect a long-held attitude, we must recognize the double agenda that he seems to have pursued in numerous treatises, and which I hope has been apparent in our description of his approach thus far.

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[32] For the Latin text drawn from Florence, Laur., Ashburnham 210, fol. 46r, col. 2, see Thorndike, *A History of Magic*, vol. 3, 469, n. 128. The Latin of the concluding sentence proclaiming Socratic ignorance is: "Certe, si bene consideras, ista sunt multum ignota multo plus quam multi articuli fidei. Ideo quidem nichil scio nisi quia scio me nichil scire." This sentence is also quoted in Bert Hansen, *Nicole Oresme and the Marvels of Nature*, 98, n. 7, from MS Paris, B.N., lat. 15126, fol. 98v, lines 29-32.

[33] "Hic possent oriri mirabiles difficultates de modis et speciebus operationum et de numeris qualitatum et diversitate earum; ... et quamvis multis appareant faciles, michi tamen difficiles videntur. Ideo nichil scio nisi quia me nichil scire scio." Hansen, ibid., from MS Paris, B.N., lat. 15126, fol. 118v, lines 11-5. Although I have not seen the manuscript, Hansen is convinced, as am I, that the quotations indicate that Oresme's scepticism is about natural knowledge.

[34] Translation by Hansen, *Nicole Oresme and the Marvels of Nature*, 97. Latin text on pp. 97-8, n. 6. The Latin text is also cited in Thorndike, *A History of Magic*, vol. 3, 455, n. 54. In the translation, I have added the crucial Latin phrase.

The first aspect of it was to reject and refute all causal explanations that relied on magic and non-Biblical miracles. Throughout his career, Oresme was a determined foe of superstition and sought at every reasonable opportunity to subvert the foundations of magic, astrology, marvels, and demonic explanations of natural phenomena. Indeed although he conceded the existence of demons, he did so largely because faith and sacred Scripture had affirmed it.[35] Without such an affirmation, Oresme could find no convincing independent evidence for their existence. The innumerable effects attributed to demons were explicable by natural causes. For this reason, he championed natural causal explanations of all celestial and terrestrial phenomena.

As the second aspect of his double agenda, Oresme focuses on natural philosophy itself, emphasizing the great difficulty of determining the precise natural cause of a particular effect. Where Buridan was confident of our ability to formulate principles of science based on repeated observations of the seeming conjunction of a cause and its effect without a single contrary instance, Oresme was pessimistic and emphasized the confusing panorama of nature's activities which made it difficult, if not impossible, to ascertain the particular natural cause of a particular natural effect. Indeed we are no better able to comprehend the causes of most natural occurrences than we are able to fathom the articles of faith. To think otherwise is to fall victim to the common, but dangerous, syndrome of "easy belief."

But Oresme's uncertainty about natural knowledge went much deeper than the difficulties of determining particular natural causes. Nature itself, he believed, consisted overwhelmingly of relationships that were incommensurable and inherently imprecise. In his *De proportionibus proportionum (On Ratios of Ratios)*, written probably in the 1350s, Oresme developed ideas that were first presented by Thomas Bradwardine in the latter's *Tractatus de proportionibus* of 1328. In the tenth proposition of the third chapter of this extraordinary treatise, Oresme demonstrated mathematically that any two unknown ratios that might be proposed would probably be incommensurable. In the fourth chapter, he applies his mathematical doctrine to the whole of the physical world when he enunciates the following proposition:

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[35] In Quodlibet 23 of his *Quodlibeta*, Oresme considers "whether it is likely, speaking naturally, that there are many demons," and replies that "if the Faith did not affirm their existence, I would say that from no natural effect could it be proved, because all (their apparent marvelous works) can be saved naturally." The translation is by Lynn Thorndike, *A History of Magic*, vol. 3, 466. For the Latin text, see Thorndike, ibid., 466, n. 114.

> When there have been proposed any two things whatever acquirable [or traversable] by a continuous motion and whose ratio is unknown, it is probable that they are incommensurable. And if more are proposed, it is more probable that any [one of them] is incommensurable to any [other]. The same thing can be said of two times and of any continuous quantities whatever.

Since in Aristotelian physics and cosmology, nature is a continuum of matter and motion, the import of Oresme's extraordinary conclusion is that the relationship between any two relatable natural magnitudes is probably incommensurable and therefore not precisely knowable. At best, such ratios can only be approximated. Thus not only are our senses largely incapable of knowing much about quantities that are quite nearby, but even if our senses were up to the challenge, the relationships they would confront would probably be incommensurable and thereby knowable only approximately. The consequences of this doctrine for science were potentially far reaching and Oresme returned to it frequently, including some dazzling use of it in his last known treatise, *Le Livre du ciel et du monde.*

Oresme used the doctrine of incommensurability primarily in the treatment of circular motions, which he could apply hypothetically to the celestial region.[36] In the *Treatise on the Commensurability or Incommensurability of the Celestial Motions*, his most extensive treatment of this subject, Oresme included twelve propositions in which incommensurable relations were assumed between any two celestial motions.[37] In these twelve propositions he sought to derive consequences that would follow from those incommensurable motions. He showed that if any two celestial motions are incommensurable, as is likely (this becomes evident from the third part of the treatise), the precise positional relationships of those bodies would be impossible to determine. If any two or three celestial bodies entered into a given astronomical aspect, say conjunction or opposition, they could never again enter into the same relationship in the future; indeed it also followed that they could never have been in that same relationship before. Because of the overwhelming likelihood of celestial incommensurability, celestial events, such as conjunctions, oppositions, and eclipses, would necessarily be unique.

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[36] In the next few paragraphs, I follow my article, *Nicole Oresme on Certitude in Science and Pseudo-Science*, in: *Nicolas Oresme Tradition et innovation chez un intellectuel du XIV^e siècle; Nicolas Oresme Tradizione e innovazione in un intellectuale del XIV secolo*, eds. P. Souffrin and A. Ph. Segonds, Paris/Padova 1988, 31-43; 37-8.

[37] For these propositions, see *Nicole Oresme and the Kinematics of Circular Motion*: 'Tractatus de commensurabilitate vel incommensurabilitate motuum celi', ed. and tr. Edward Grant, Madison, Milwaukee, and London 1971, Part II, 248-83 for the text and translation; and 37-67 for a summary.

At first glance, the implications of the probability of celestial incommensurability should have been devastating for the science of astrology. Astrologers assumed that celestial motions not only influenced terrestrial events—natural philosophers also held this opinion—but also that the same celestial cause always produced the same effect. On the assumption of celestial incommensurability, however, no celestial relationships would be precisely repeatable from which it followed that the same cause could never repeat and therefore neither could its precise effect.

Oresme himself was delighted with this situation. Approximations were all we could hope for and they ought to be sufficient for human purposes. He would even proclaim that "Any one who announces results that are free of noticeable error would seem to have determined things adequately and beautifully."[38] Indeed, according to Oresme, the impossibility of attaining precise knowledge about the heavens was actually advantageous because it was desirable for humans that "something should always remain unknown, so that it may be investigated further."[39] To know celestial events with complete precision would make humans like the immortal gods, an idea that Oresme found repugnant.

The implications of Oresme's doctrine of incommensurability for the scientific study of the physical world were potentially profound. By its very nature, the world could not be known with precision. All the sciences concerned with continuous physical magnitudes were at best approximative. In astronomy and terrestrial physics, Oresme was quite content to settle for approximations. He realized that terrestrial velocities would probably arise that were mutually incommensurable so that the ratios of force to resistance that gave rise to them could not be derived or inferred. But if the precise ratios of force to resistance could not be derived, the next best thing was to

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[38] Ibid., 319.

[39] Ibid., 321.

> investigate whether any ratio given, or to be given to us, is greater or smaller than such an irrational, unknowable, and unnameable ratio...In this way we can find two ratios sufficiently close so that such an unknown ratio will be greater than the lesser and smaller than the greater. And this ought to suffice.[40]

4. "Natural Impossibilities" and Equally Plausible Alternatives to Fundamental Aristotelian Conceptions

We are not yet done with the ways in which Oresme knowingly weakened confidence in the natural philosophy of his day. A favorite technique was to show that possible, and even plausible, alternatives existed to basic Aristotelian principles that were widely held. Thus did Oresme find it convenient to use his doctrine of the probable incommensurability of the celestial motions to undermine Aristotle's claim that whatever had a beginning must have an end and what has no end cannot have had a beginning.[41] For Aristotle, the world was a prime example of the latter condition—as an eternal entity, it had neither beginning nor end. Using the sun as example, and assuming that at least one of its three simultaneous motions was probably incommensurable to at least one of the other two, Oresme argued that the apex of the earth's shadow, which depended on the position of the sun's center, could never occupy the same celestial point twice. Thus the apex of the earth's shadow would necessarily occupy one point after another in which it had never before been and to which it could never again return. In every point it occupied, some portion of the sunlight in the sky, which had existed there from all eternity, and was, therefore, without any beginning, would be darkened and come to an end. But at the moment when the apex of the shadow shifted to the next point, sunlight would once again shine on the darkened point that was just vacated and shine there ever after through all future eternity. Thus did Oresme show that something that had no beginning could come to an end; and something that had a beginning need not have an end.[42] While Oresme's argument is not a refutation of the eternity of the world, it seems to suggest that, "naturally speaking," it is also possible that the world might have a beginning and no end; or it might have a beginning and an end, which was the traditional belief from the standpoint of faith. Although he believed that Aristotle's position on the eternity of the world was contrary to the faith, Oresme explains the purpose of his counterargument: "I want to demonstrate the opposite according to natural philosophy and mathematics. In this way it will become clear that Aristotle's arguments are not conclusive."[43] Aristotle's arguments are ultimately indecisive because Oresme has imagined natural, rather than supernatural, alternatives and counterinstances that are possible, and perhaps even plausible on the assumption of celestial incommensurability.

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[40] From Oresme's *De proportionibus proportionum*, ch. 4, Prop. VI, 289-291 for translation and 47-48 for discussion.

[41] For Aristotle's discussion, see *De caelo*, bk. 1, chs. 10, 12.

In a similar vein, Oresme argued about the possibility of a plurality of worlds, which Aristotle had denied. Here again, Oresme shows the inconclusiveness of Aristotle's position by formulating possible alternatives, which Aristotle had thought impossible. One conception of a plurality of worlds was to imagine concentric worlds—that is, worlds within worlds, or, as Oresme expressed it, "at one and the same time one world is inside another so that inside and beneath the circumference of this world there was another world similar but smaller." Indeed Oresme envisioned worlds even beyond ours that surround us concentrically and even suggests that similar worlds might exist within the moon. He admits that this is a mere speculation, one that he wanted "to toy with as a mental exercise (*par esbatement*)." But Oresme explains that "Although this is not in fact the case, nor is at all likely, nevertheless, it seems to me that it would not be possible to establish the contrary by logical argument."[44] Nor indeed is there any "proof from reason or experience or otherwise that such worlds do exist." "Therefore," Oresme continues, "we should not guess nor make a statement that something is thus and so for no reason or cause whatsoever against all appearances; nor should we support an opinion whose contrary is probable." Nevertheless,

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[42] This example occurs in Oresme's *Le Livre du ciel et du monde*, bk. 1, ch. 29 in: *Nicole Oresme: Le Livre du ciel et du monde*, eds. A. D. Menut and A. J. Denomy C.S.B; tr. A. D. Menut, Madison, Wis. 1968, 199. For more on this subject, see Grant, *Scientific Thought in Fourteenth-Century Paris: Jean Buridan and Nicole Oresme*, 113-4 and 123, n. 43.

[43] This passage is from *Le Livre du ciel et du monde*, ed. cit., 195-7.

[44] Ibid., 167.

Oresme concludes by reiterating his main purpose: "it is good to have considered whether such opinion is impossible."[45]

But what of the more traditional and plausible concept of a plurality of worlds, where the worlds exist simultaneously, each lying entirely outside of every other? Oresme offers a brilliant series of arguments to show the plausibility and intelligibility of the existence of other simultaneous, separate worlds. In the process, he redefines the concept of natural place and up and down.[46] Moreover, he even accepts the existence of an infinite, extracosmic void space in which these worlds could exist.[47] Although, by His omnipotence, God could create such worlds, and neither Aristotle nor any one else could prove the contrary, Oresme concludes that "of course, there has never been nor will there be more than one corporeal world, as was stated above."[48] Once again, Oresme is content to adopt the traditional Aristotelian opinion. But he makes certain that the alternative interpretation is made as plausible as possible, so plausible, in fact, that it renders Aristotle's dominant opinion inconclusive. Indeed he has contradicted Aristotle: what was impossible in Aristotle's natural philosophy, Oresme has been shown to be possible, intelligible, and even plausible.

5. *Buridan and Oresme: On the Possible Axial Rotation of the Earth*

Both Buridan and Oresme considered whether the astronomical phenomena could be better explained by the earth at rest in the center of the world with the heaven moving around it; or, whether the converse was true, namely that the earth was in daily rotation at the center of the world and the heavens at rest above. They were agreed that the astronomical phenomena were compatible with either hypothesis and offered some brilliant arguments to sustain their positions. Buridan, however opted for the traditional opinion of an immobile earth because of certain observational consequences that should have followed from his impetus theory.[49] If the earth actually rotated, an arrow shot upward ought to follow the earth's rotatory path and fall back to the approximate place from which it was shot. Buridan denied this consequence by appeal to his famous impetus theory. When the arrow is projected, a sufficient quantity of impetus is impressed into that arrow to allow it to resist the lateral motion of the air as the latter accompanies the earth in rotatory motion. In resisting the motion and push of the air, the arrow should lag behind earth and air and drop noticeably to the west of the place from which it was launched. Since this is contrary to experience, Buridan concludes that the earth is at rest.

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[45] Ibid., 171.

[46] For a brief summary, see Grant, *Scientific Thought in Fourteenth-Century Paris: Jean Buridan and Nicole Oresme*, 114-5.

[47] See *Le Livre du ciel et du monde*, 177.

[48] Ibid., 179.

[49] For the remainder of the paragraph, I follow Grant, *Scientific Thought in Fourteenth-Century Paris: Jean Buridan and Nicole Oresme*, 110-1.

Unlike Buridan, Oresme, in a lengthy treatment of this theme in his *Le Livre du ciel et du monde* of 1377, could find no experience that would enable him to determine the issue. Nor indeed could he find any rational arguments that could tip the scale in either direction. But Oresme found some impressive non-astronomical arguments based on simplicity and harmony which seemed to favor an axial rotation. He even invoked the Joshua miracle in its favor. At the end of his lengthy discussion, however, Oresme opted for the traditional opinion of an immobile, non-rotating earth. He conceded, however, that, "after considering all that has been said, one could then believe that the earth moves and not the heavens, for the opposite is not clearly evident." Although one might with equal justification adopt the earth's daily rotation over that of the heaven, Oresme rejects this move because Psalms 92:1 says that "God hath established the world which shall not be moved" and also because the earth's axial rotation "seems as much against natural reason as, or more against natural reason than, all or many of the articles of our faith." He goes on to add that what he said as an intellectual exercise or a diversion (*par esbatement*) may prove useful against "those who would like to impugn our faith by argument."[50] Oresme categorizes the axial rotation of the earth as a concept that is against natural reason and even more against natural reason than are the articles of faith. Here, as he did in 1370 in his *Quodlibeta*, Oresme invokes the faith in order to denigrate natural knowledge. Immediately preceding his profession of Socratic ignorance in the *Quodlibeta*, Oresme insists, as we saw earlier, that many things about natural knowledge are more unknown than are the articles of faith. Seven years later, in his *Le Livre du ciel et du monde*, he insists that the earth's possible axial rotation seems more contrary to "natural reason" than many or all articles of the faith. Thus Oresme used his faith as a measure for determining the status of natural reason as applied to natural phenomena. In his judgment, the application of natural reason produced results that were, in many instances, less plausible than the articles of faith.

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[50] See *Le Livre du ciel et du monde*, 537-9.

Both Buridan and Oresme deserve high praise for their unusual arguments in favor of a rotating earth. Each, however, rejected it for different reasons, thereby revealing how dissimilar were their approaches and attitudes. Buridan arrived at his conclusion on the basis of rational arguments and the senses, completely ignoring Scripture and faith; Oresme ultimately decided the issue on the basis of Scripture and faith.

6. *The Final Comparison*

If one examined certain treatises that Buridan and Oresme wrote in common, say their *Questions on De caelo*, or perhaps their *Questions on De anima*, it would probably appear that their approaches were rather similar. Both emphasize natural causes and both assume that the common course of nature is rarely interrupted and that we might have to settle for approximations rather than absolute precision and certainty. One might even be tempted to adopt Edith Sylla's interpretation, which assumes that "Oresme's position on the epistemological status of natural philosophy was similar to Buridan's. Thus for him natural philosophy would not be absolutely certain, but it would be sufficiently certain *ex suppositione*"[51]—that is, on the assumption of the "common course of nature." It is only when we leave Oresme's questions on the works of Aristotle and examine his thematic treatises, along with his French commentary on Aristotle's *De caelo*, that we discover an Oresme who is separated from Buridan by an intellectual abyss.

Although Oresme was convinced that natural causes—not God or demons—were responsible for virtually all seemingly magical and marvelous effects, we saw how firmly convinced he was that those natural causes were rarely determinable or identifiable. Our senses were too easily fooled.

Part, perhaps a large part, of the difference between Buridan and Oresme may derive from their disciplinary allegiances. As a Master of Arts and professional natural philosopher, Buridan sought to free natural philosophy from theology and to make of it an independent discipline using reason as contrasted with theology's dependence on revelation. Reason and revelation were distinct and must not be conflated or intertwined. Buridan emphasized reason, sense-perception, and experience and trusted them all. Faith provided truths that were not intelligible to reason. As a professional natural philosopher, it was not in Buridan's interest to downgrade the essential instruments of natural philosophy: reason, sense-perception, and experience.

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[51] *Galileo and Probable Arguments*, 217.

Oresme's approach was radically different. For him there was only a single truth which was sought by both philosophy and faith. The eternity of the world, for example, was not something that was plausible from the standpoint of reason except for the mere inconvenience that God had chosen to create our world supernaturally. For Oresme, there was only one unequivocal truth: the world had a beginning not only because God had created it, but also because the attribution of a beginning to it was compatible with reason. The eternity of the world was simply untrue, although Oresme could not demonstrate it. He could only show, by use of his incommensurability doctrine, that the major argument for eterntiy was inconclusive, namely that something that had a beginning must have an end and what has no end cannot have had a beginning.

In stark contrast to Buridan and almost all natural philosophers, Oresme chose to blur, if not obliterate, the distinctions between reason and faith.[52] He was convinced, as we saw, that the articles of faith were as reasonable and knowable—and perhaps even more reasonable and more knowable—than many natural occurrences, many of which are at least equally unknown, as, for example, prime matter, the nature of accidents, the generation of new forms, how fire burns, and indeed the very nature of things. It was, at least on the face of it, such basic human limitations that prompted Oresme's confession of Socratic ignorance. Where Buridan always emphasized our ability to acquire natural knowledge and the means to do so, Oresme laid heavy emphasis on pitfalls and limitations in the acquisition of natural knowledge. Not only were our senses inadequate and untrustworthy, but his doctrine of incommensurability showed that nature was probably inherently imprecise and therefore not exactly knowable. By emphasizing an approximate equality in intelligibility and knowability of philosophy and faith, Oresme appears to have intended deliberately to denigrate natural philosophy and its pretensions to natural knowledge. If the truths of revelation and Scripture are accepted on faith, on what basis do we accept the propositions of natural knowledge? They seem to require as much of an act of faith as do the truths of revelation.

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[52] Thorndike remarks (*A History of Magic*, vol. 3, 469-70) that Oresme was unwilling, "as one might infer from his remark that no truth is contrary to other truth, to accept religious dogma as one body of truth and to discuss matters of philosophy and science apart from it as a separate affair. He sometimes obtrudes theological dogma into scientific discussion."

Oresme's double agenda was thus an effort to replace superstitious explanations of phenomena with explanations based on natural causation, while at the same time depicting natural causation and natural knowledge as no more intelligible than the articles of faith. In the final analysis, Oresme's goal was to make faith the centerpiece of all knowledge. In terms of reason it was as plausible and intelligible as much of natural knowledge. But it had the advantage of being absolutely certain by virtue of divine revelation, an advantage that natural knowledge lacked.

What we may have here is a disciplinary difference. Buridan, the quintessential natural philosopher, emphasizes the reliability of natural knowledge, which can be had with reason and experience with all the accuracy that is required. Oresme, the theologian trained also in natural philosophy, regularly assumes the common course of nature with its natural causality but tirelessly emphasizes the unreliability and uncertainty of natural knowledge, which may have less credibility from the standpoint of reason than the articles of faith.

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Vivarium XXXI, 1 (1993) ©E.J. Brill, Leiden

Connotative Concepts and Mathematics in Ockham's Natural Philosophy

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Introduction

In William of Ockham's logic of terms and concepts, one of the most important distinctions that he makes is that between absolute terms and concepts and connotative terms and concepts. This essay presupposes some acquaintance with Ockham's notions of signification, supposition, and mental language, focusing immediately on absolute terms and concepts. Aside from texts where Ockham's analysis applies his notions and distinctions, his most explicit treatment is found in the *Summa Logicae.*[1]

Ockham begins his account by indicating what absolute terms are not—absolute terms do not signify one thing primarily and another thing or the same thing secondarily but rather primarily signify each thing equally.[2] For example, the term 'animal' primarily signifies cows, asses, and men equally.[3] The term does not signify one primarily and the others secondarily, nor does it require that something be expressed in a nominative case and something else in an oblique case. Absolute terms do not have nominal definitions, for nominal definitions require that some things be expressed in different grammatical cases or adverbially.

Even if an absolute term is understood in different ways, as long as the different definitions do not signify something in the same way as another definition, then the definitions are not nominal definitions and hence the term is an absolute term. In the list of absolute terms provided by Ockham we may finally note that it includes concrete individual substances, concrete continuous objects such as bodies of water, and abstract qualities.

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[1] *Summa Logicae*, ed. Philotheus Boehner, Gedeon Gál, and Stephen Brown, *Opera Philosophica* I, St. Bonaventure 1974, henceforth referred to as *SL*, and cited by part, chapter, and pages.

[2] *SL* 1. 10, pp. 35-6.

[3] I adopt here single quotation marks after the edition and in conformity with modern logical conventions rather than the more grammatically correct use of double quotation marks.

We may surmise that absolute terms include abstract and concrete substance terms and some abstract quality terms, and that such terms have real, not nominal, definitions. By 'real definition' Ockham means "a concise phrase that expresses the whole nature of the thing and that does not refer to anything extrinsic to the thing defined."[4] Hence, an absolute term has a real definition expressing the nature of the things falling under the definition. Ockham distinguishes metaphysical definitions, real definitions that include only nominative-case terms, from natural definitions, real definitions that also include oblique-case expressions under the condition that those expressions signify only the essential parts of the thing. Examples given by Ockham are, respectively, "Man is a rational animal" and "Man is a substance composed of body and intellective soul."

In *Summa Logicae* 1. 10, Ockham defines connotative terms immediately after his definition of absolute terms.[5] Taking up characteristics mentioned in the definition of absolute terms, Ockham defines connotative terms as terms having nominal definitions. Under connotative terms Ockham includes concrete quality terms such as 'white'. It bears emphasis that Ockham defines absolute terms in terms of or by contrast with connotative terms.

Ockham explicates connotative terms at greater length, adding that the concrete terms that signify things in ways that their abstract counterparts do not signify (for example, 'white' and 'whiteness' or 'just' and 'justice') are connotative terms, because such concrete terms signify one thing directly (in the nominative case) and something else in an oblique case. For example, the nominal definition of 'white' such as 'something having whiteness' has a term in the nominative case and another in an oblique case.[6]

Next, Ockham includes relative terms among and under connotative terms,[7] and he maintains that all terms belonging to the genus of quantity are connotative terms.[8] Ockham concludes this chapter distinguishing absolute from connotative terms by listing a variety of terms that include transcendental terms such as 'true', 'good', and 'one', and several other terms that satisfy the conditions that he has set out.[9]

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[4] *SL* 1. 26, p. 85: "...accipitur hoc nomen 'definitio' stricte, et sic est sermo compendiosus, exprimens totam naturam rei, nec aliquid extrinsecum rei definitae declarans."

[5] *SL* 1. 10, pp. 36-7.

[6] Ibid., p. 37, ll. 52-8.

[7] Ibid., p. 37, ll. 59-64.

[8] Ibid., pp. 37-8, ll. 65-80.

In his explanation of 'nominal definition' in *Summa Logicae* I. 26, Ockham maintains that terms of non-existent, indeed, even of impossible "things" can be defined without the implication that the putative things do exist. Terms of such putative things have nominal definitions. It bears emphasis that several of these terms are expressed in a negative form or imply a negative. Other terms seem to be artificially compounded from absolute terms. Both the negative as well as the artificially compounded terms are connotative terms. In sum, then, we may say that all concrete quality terms and some abstract quality terms, all the terms in the other eight accidental categories, relative terms, fiction terms, and transcendental terms (except 'being') are connotative and have nominal definitions.[10]

So much for an initial description of Ockham's distinction between absolute and connotative terms. This essay is also concerned with Ockham's interpretation of mathematical "objects." With respect to mathematical entities such as numbers and geometrical figures such as points and lines, contemporary nominalists hold that such entities are mere abstractions and do not really exist, that is to say, they are abstract, mental entities, not concrete, real entities. Ockham agrees with contemporary nominalists in the sense that he does not regard mathematical terms and concepts as absolute terms and concepts. Ockham regards them as connotative terms and concepts. As connotative, these terms and concepts do not refer to some one distinctly existing thing and yet they do signify in some fashion real things. This essay will return to these issues below in Part 2.

Before we can proceed, however, we must come to grips with the current standard account of connotative terms and concepts. This essay argues that the standard, analytic accounts of Ockham on connotation have committed an error so serious and so fundamental that they are unable to appreciate, let alone explain, Ockham's theory of connotation and the absolutely indispensable role that connotative terms and concepts play in Ockham's discussion of basic concepts in natural philosophy such as motion, time, and place, as well as Ockham's treatment of mathematical concepts and the role of mathematics in natural philosophy.

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[9] Ibid., p. 38, ll. 81-94.

[10] Ibid., p. 88, ll. 114-21. We may also add that if it makes sense to speak of substance terms as fictional or negative, then some substance terms are also connotative. On the other hand, Ockham may have regarded the expression "fictional substance term" as an oxymoron.

Unfortunately, this essay can go only one step further towards a constructive account of Ockham's view of connotation, because analysis over the past two decades has been bogged down by very influential reductivist accounts that must be dislodged before a constructive analysis will even be possible. This task is undertaken with some reluctance because my understanding has benefited a great deal from the methods and approaches of analytic philosophers. Nevertheless, analytic philosophers have not displayed the same openness to non-analytic approaches, especially those that stand squarely in the tradition of the history of ideas and of the history of science. To make the controversial dimension of this essay complete, we must point out that the nearly classic reductivist interpretation in the analytic style appeared in the pages of this very journal.[11]

The implications of this critique of the standard account for our understanding of fourteenth-century natural philosophy, especially of a Mertonian variety, are important. This essay will conclude with concrete suggestions in this direction, but its complete delineation is another project. Indeed, as indicated, even with respect to Ockham on connotation, this essay will conclude with a challenge and suggestions rather than attempt to provide a definitive analysis. Hence, the essay is principally diagnostic and it suggests how a less reductivist approach to Ockham's texts may lead to a better understanding of fourteenth-century natural philosophy, and especially of Mertonian mechanics.

1. A Selective Survey of Interpretations of Ockham's Connotation-Theory

Although Paul Spade's account has been accepted by some of the most competent analytical philosophers of medieval thought, there were historians[12] who expressed misgivings and even one analytic philosopher, Claude Panaccio, who has attacked it vigorously.[13] That attack appeared in a publication which, so far as I can tell, has generated little reaction or response. So, while Panaccio's critique is thorough in its treatment, its neglect enjoins us to summarize Spade's thesis, cite the support for it by Marilyn Adams, Calvin Normore, and Alfred Freddoso, summarize Panaccio's critique, and then attempt to place the interpretative history in context so as to bring it up-to-date and to suggest a direction for the further elaboration of Ockham's account of connotative concepts. Only then can we focus on the relevance of these issues for fourteenth-century Aristotelian natural philosophy.

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[11] Paul V. Spade, *Ockham's Distinctions between Absolute and Connotative Terms*, in: Vivarium, 13 (1975), 55-76.

[12] See John Murdoch, Scientia mediantibus vocibus: *Metalinguistic Analysis in Late Medieval Natural Philosophy*, in: *Sprache und Erkenntnis im Mittelater, Miscellanea Mediaevalia*, 13/1 (1981), 73-106, esp. 76, n. 8: "Yet perhaps this [Spade's interpretation] attempts to make things too 'neat'; Ockham never explicitly tells us, to my

1.1. Spade's Analysis

Paul Spade presented his account modestly as restricted to part of Ockham's connotation-theory, namely, that part that requires no new primitive notions beyond those already required for the theory of absolute terms. At the end of the section I shall return to Spade's restriction to only a part of Ockham's connotation-theory. Early in his essay, Spade found it necessary to supply interpretations on Ockham's behalf that are then attributed to Ockham even though in Ockham, by Spade's own admission, no explicit statement in support of the interpretation and its generalization can be found. As Spade puts it, "the generalization seems plausible." Typical of this kind of analysis, views are attributed to Ockham on the basis of what the interpreter thinks logic and consistency demand. This is not an unusual procedure, and this is especially true for interpretations of Ockham who often leaves the reader to speculate about his complete meaning. Spade occasionally seeks support for his interpretation in the texts of John Buridan who is occasionally more explicit in enunciating some principles. The strategy amounts to the following inference: if we want

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knowledge, just which kinds of terms are to be allowed in a mental language." In addition, Spade's account was clearly at odds with the most comprehensive study of Ockham's philosophy and theology in any language, Jürgen Miethke's *Ockhams Weg zur Sozialphilosophie*, Berlin 1969 and the even earlier seminal study by Gottfried Martin, *Wilhelm von Ockham, Untersuchungen zur Ontologie der Ordnungen*, Berlin 1949.

[13] Claude Panaccio, *Connotative Terms in Ockham's Mental Language*, in: Cahiers d'épistémologie, no. 9016, Montréal 1990. See also John Boler, *Connotative Terms in Ockham*, in: History of Philosophy Quarterly, 2 (1985), 21-37, an article that partly agrees and partly disagrees with Spade's analysis. Most importantly, Boler's disagreement is with Spade's treatment of denominative and relative terms.

to preserve Ockham's thought as coherent and consistent, then these additional principles must be attributed to him. Indeed, Spade calls one of these the *Additive Principle.*[14]

The crucial reductivist move is made by Spade in his section on mental language where Spade makes two assumptions that are central to his analysis.[15] The first reads: "(5) There is no synonymy in mental language."

Spade places great emphasis on Ockham's insistence that a term having a nominal definition uses an expression one part of which signifies something not conveyed in the same way by another part of the other expression. Spade transforms this explanation into an affirmative biconditional that constitutes his second central assumption:[16]

> (7) A term has a *definition* expressing the *quid nominis* (what we more commonly call a "nominal definition") if and only if all the expressions expressing its *quid nominis* signify the same things "in the same way".

Spade shortly thereafter offers the following principle on Ockham's behalf:[17]

> (9) All the expressions expressing the *quid nominis* of a term *t* are synonymous if and only if *t* is itself synonymous with each of those expressions.

From (9) by way of (5) Spade further concludes:[18]

> (10) There are no simple connotative terms in mental language; all simple or non-complex concepts are absolute mental terms.

And the last inference relevant to this analysis is:[19]

> (11) Every connotative term is synonymous with a fully expanded

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[14] Spade, 58: "(1) A complex expression signifies just exactly the sum total of what is signified by its constituent non-complex categorematic terms."

[15] Ibid., 63.

[16] Ibid., 64.

[17] Ibid., 67.

[18] Ibid., 67.

[19] Ibid., 70. In the footnote for this conclusion Spade cites Ernest Moody, *The Logic of William of Ockham*, New York 1935, especially p. 35 for support: "If connotative terms could not be defined, or analysed, into functions of absolute terms, we would either have no means of demonstration, or else demonstration would involve infinite regress or circularity." In my view, Moody is correct, but Moody does not say, however, that such an analysis into functions of absolute terms must be completely reductive. What satisfies a definition or analysis into functions is not specified, but the completely reductive criterion is a further condition. Note the remark by Boler (n. 13 above) 36, n. 38, on Moody, and compare with my *Physics of William of Ockham*, Leiden 1984, 15-9 and 210-9.

nominal definition, each of whose constituent non-complex categorematic terms is absolute.

This conclusion expresses what Spade set out to show, namely, that

> ...connotation theory, or at least that part of it presented here, requires no new primitive notions beyond those already required for the theory of absolute terms.[20]

It should be clear now that Spade's restriction to part of Ockham's theory of connotation is a tautology: the reductivist assumptions apply to only part of Ockham's theory and hence is true for that part, whatever else Ockham's theory may include. Spade does not even suggest, however, how any other part of connotation theory might not have to conform to this requirement. The implication is clear that those other parts would either have to conform to the same requirement or there would be an inconsistency in Ockham's theory. The result would then be the same—the reductivist analysis works for the part that is self-consistent, and if it fails to work for the rest, then the rest is inconsistent.

1.2. Adams, Normore, and Freddoso

Paul Spade focused his attention on Ockham's *Summa Logicae.* The 1975 paper does not betray a wide or deep acquaintance with Ockham's texts, hence one could excuse Spade for relying too narrowly on Ockham's explicit statements in a logical text without adequate comparison with other contexts.

But it could hardly be said that Marilyn Adams is unacquainted with Ockham's texts. Like most analytic philosophers, she seems to have neglected, relatively speaking, Ockham's polemical treatises, but she has read all of Ockham's non-polemical works carefully and often minutely. That someone as acquainted with Ockham as she is should subscribe to some of the most questionable assumptions in Spade's analysis is surprising, especially in light of a paper that appeared in a collection dealing with questions about how philosophers treat "hows."[21]

Adams contends that Ockham's "examples and discussions suggest the view that a fully expanded nominal definition of connotatives would include only absolute terms and primitive syncategorematics not capable of further definition themselves.''[22] Adams agrees with Spade's account although the remainder of her paper suggested that there was strong pressure to extend Ockham's analysis to admit the existence of modes or accidents into his ontology.[23] But Adams rightly concludes that such solutions were not available to Ockham. Adams formulates a cautious propositional interpretation that does not lead to a hypostatization of modes of being or how things are. Although she concludes that Ockham never completed the reductive program ''by stating truth-conditions for statements about how things are related, quantified, active, etc., using absolute terms that name only substances and qualities'',[24] there were issues raised by Adams that promised progress towards a more adequate interpretation of Ockham on connotative terms and concepts.

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[20] Ibid., p. 55.

[21] See Marilyn McCord Adams, *Things Versus "Hows", or Ockham on Predication and Ontology*, in: *How Things Are*, ed. James Bogen and James E. McGuire, Dordrecht/Boston 1984, 175-88.

That hope has unfortunately not been fulfilled, as is clear from her account in *William Ockham.*[25] The relevant passage reads:[26]

> Strictly speaking, a nominal definition not only identifies the extension of a term—this it would do if it were truly predicable and hence directly signified all and only those things about which the term was truly predicable—but also is *synonymous* with it, and hence subordinated to the same concept or concepts in the mental language. For one term or phrase to be synonymous with another, not only their primary but also their secondary significata must be the same; and they must signify their secondary significata the same way. Ockham's examples of nominal definitions, as well as his lumping together of syncategorematics, connotatives, and negatives in *Ordinatio* I, d.2, q.8, make attractive the thesis that on his view, a full expanded nominal definition of connotatives would include only absolute terms and primitive syncategorematics not capable of further definition themselves. Insofar as he holds to this claim that there is no synonym in the mental language, Ockham will be committed to the view that connotative terms in conventional language are subordinated to arrays of primitive syncategorematics and absolute terms in the mental language. And the conventional language explanation of what the terms [sic] signifies, that counts as a nominal definition of that term will be subordinate to the same array.

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[22] Ibid., 177.

[23] In her note 6, pp. 187-8, Adams also points out that Spade's formula for identifying the secondary significata of a term is too narrow, but she does not reject the adequacy of Spade's analysis for what it does cover.

[24] Ibid., 187.

[25] Marilyn McCord Adams, *William Ockham*, 2 volumes, Notre Dame 1987. See Paul Spade, *Ockham, Adams and Connotation: A Critical Notice of Marilyn Adams's*, William Ockham, in: The Philosophical Review, 99 (1990), 593-612. In this essay review, Spade repeats the reductive, eliminability thesis.

[26] Ibid., I, 322-3.

There are again some indications in this passage that Adams is not altogether comfortable with Spade's reductivist analysis, yet she accepts the premisses, seems to cite Spade approvingly in the relevant footnote, and she offers no reason for not accepting Spade's thesis. These arguments sometimes take the form that Ockham *should have held* certain views or principles, even if explicit evidence is lacking:[27]

> ...to decide whether both the concrete term 'white' and the abstract term 'whiteness' are included in the mental language, he [Ockham] needs to consider not only whether 'white' is synonymous with 'whiteness', but whether or not either is synonymous with some other term or complex of terms found in the mental language: e.g., with 'something having whiteness'. Ockham maintains that all connotative terms are susceptible of nominal definitions the way 'white' is. And a development of his logic...*would conclude* that all connotative terms are synonymous with complexes of primitive syncategorematics and absolute terms that name substances or qualities...If so, Ockham *should* have...regarded all connotative terms and hence all terms in the categories other than substance and quality as in principle eliminable in favor of such complexes. (Italics added.)

This is basically the same strategy that we detected in Spade. Adams's recognition that the full development of Ockham's proposal requires the formulation of truth-conditions for statements about how things are related, quantified, active, and so forth is surely correct, yet the condition for the possibility of its fulfillment has been frustrated by an implausibly narrow, overreductionistic interpretation of Ockham's connotation-theory.

In the context of the issues discussed here, Normore's focus has been on Buridan, and he seems to have developed a clear understanding of what Buridan was about. But on Ockham he accepts Spade's conclusion that there are no simple connotative terms in mental language:[28]

> ...absolute terms have only primary signification. Ockham claims that from this it follows that they have no nominal definition. His argument seems to be that any term which has a nominal definition is synonymous with its definition... Absolute terms do not have nominal definitions; connotative terms do. If mental language has no synonyms, then since a term and its nominal definition must be synonyms, there is no place in mental language for both. The terms which appear in the definition of a connotative term typically have other uses and so will usually be required for the expressive adequacy of mental language. It

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[27] For instance, this is how Adams puts it, I, 297-8. See Spade's essay review (n. 25) for new observations, suggestions, and details of differences between himself and Adams, but also note continued insistence on the eliminability of connotative terms in mental language.

[28] Calvin Normore, *Ockham on Mental Language*, in: *Historical Foundations of Cognitive Science*, ed. J-C. Smith, Dordrecht/Boston 1990, 53-70, esp. 58.

> seems, then, though Ockham appears never to draw the conclusion explicitly, that if mental language has no synonyms it has no simple connotative terms.

Likewise, in an article on the Eucharist, Freddoso repeats this view:[29]

> ...it is sufficient to note that this distinction [between absolute and connotative terms] has rather controversial metaphysical underpinnings. To put it succinctly, absolute terms have real (rather than nominal) definitions because they signify things in a metaphysically basic and privileged way, whereas connotative terms are non-basic and in theory eliminable in favor of formulas (nominal definitions) whose only categorematic terms are absolute. The implicit assumption is that we could in principle give an ontologically adequate description of the world without using any connotative terms.

Sadly, what all of this amounts to are analytically more rigorous versions of the nonsense proposed and disseminated by P. Doncoeur.[30] Now Doncoeur focused his attention on relative terms and concepts, but it is especially in this type of connotative term that Spade, Adams, Normore, and Freddoso should have noticed the implausibility, indeed, impossibility of the overreductionistic interpretation. Doncoeur's analysis was demolished by Gottfried Martin,[31] but it does not appear that Spade, Adams, Normore, or Freddoso read Martin, or if they did so, then they missed the point. Be that as it may, Claude Panaccio has now laid out a devastating critique of Spade's analysis, that is necessarily damaging for the views of Adams, Normore, and Freddoso.

1.3. Panaccio's Critique

Panaccio has read Ockham widely, and it seems to him on the face of it impossible that Ockham could have held the views attributed by Spade to Ockham. If Spade were correct, it would be fatal for Ockham, for "it is logically impossible to construct all relational concepts exclusively from non-relational simple ones," from which it follows that there must be simple connotative terms in mental language and simple relational concepts.[32] But aside from the discomforting possibility that Ockham's doctrine would be doomed to failure as a consequence of Spade's interpretation, Panaccio demonstrates that Ockham never uttered the doctrine attributed to him.

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[29] Alfred Freddoso, *Logic, Ontology and Ockham's Christology*, in: The New Scholasticism, 57 (1983), 293-330, esp. 323. In fairness to Freddoso it should be pointed out that he later rejected this interpretation in an oral response to Marilyn Adams's book, but to my knowledge his critique has not appeared anywhere in print.

[30] P. Doncoeur, *Le Nominalisme de Guillaume Occam. La Théorie de la relation*, in: Revue néo-scolastique de philosophie, 23 (1921), 5-25.

[31] Gottfried Martin, *Ist Ockhams Relationstheorie Nominalismus?*, in: Franziskanische Studien, 32 (1950), 31-49.

[32] Panaccio, p. 2. For another very recent critique of the Spade-Adams reductionist view, see Martin Tweedale, *Ockham's Supposed Elimination of Connotative Terms and his*

Panaccio shows that Ockham posited a real distinction between absolute, connotative, and relative concepts, maintaining that they do not coincide except as superior to inferior, and citing examples that use simple terms.[33] In his *Commentary on the Sentences*, Ockham asserts that God can be known by us through a simple connotative and negative concept that is proper to him.[34] Hence, there are simple connotative terms in mental language. As for the claim that connotative terms are identical with their nominal definitions, Ockham says that a definition is not identical with what is defined; indeed, a definition is more explicit than what is defined.[35]

The thesis that all connotative terms are liable to fully expanded nominal definitions, "each of whose constituent non-complex categorematic terms is absolute," cannot possibly be true for correlative terms such as 'father', 'child', 'double', and 'half'. In fact, Ockham himself asserts that when two relative terms are mutual, the nominal definition of one cannot be expressed except through the other.[36] The complete nominal definition of each of these terms must include its correlative, hence "some relational terms (if not all) cannot be defined without recourse to other relational terms," and since all relational terms are connotative, it further follows that connotative terms are not dispensable in mental language as Ockham understands it.[37]

Ontological Parsimony, in: Dialogue, Canadian Philosophical Review/Revue canadienne de philosophie, 31 (1992), 431-44. Tweedale agrees with the principal claim in Panaccio, namely, that connotative terms and their definitions occur in Ockham's mental language; however, he also points out several important disagreements and offers another diagnosis and solution. In my view, Tweedale's diagnosis and solution leave fundamental questions about why Ockham requires connotative terms in his mental language without a satisfactory explanation.

[33] Ibid., p. 6. Panaccio cites Ockham's *Quodlibeta septem*, V, q. 25, *Opera Theologica*, IX, 583.

[34] Panaccio, 7, citing *Ordinatio* I, d. 3, q. 2, *OTh* II, 405.

[35] Panaccio, 6-7, citing *Quodlibeta* V, q. 15, *OTh* IX, 541; *SL* 1. 26, *OPh* I, 88; *SL* 3.3.22, *OPh* I, 680; *SL* 3.2.15, *OPh* I, 530; and *Summula Philosophiae Naturalis* I, c. 3, *OPh* VI, 162.

[36] *Quodlibeta* VI, q. 24, *OTh* IX, 676.

[37] Panaccio, pp. 10-1, citing *SL* 3.3.26, *OPh* I, 690. In my view, the observation by Tweedale (n. 32) that a broader construal of 'definition' does not require recourse to other relational terms in the definition of a relational term does not adequately address the condition stipulated here, namely, of a *complete* nominal definition.

In sum, Panaccio has shown that 1) ''definitions are always distinct from the terms they define''; 2) ''some connotative concepts are simple''; and 3) ''relative concepts cannot all be defined with the sole help of absolute terms and syncategoremata.''[38] In the last two parts of his paper, Panaccio shows, contrary to Spade, Adams, and Normore, that ''nothing in Ockham's writings requires that there be a total synonymy between a connotative term and its definition''; in fact, the principles attributed to Ockham by Spade and the others lead to inconsistencies with explicit statements that Ockham does make. For instance, Ockham maintains that non-relative connotative terms such as 'quantity', 'motion', 'time', 'figure', 'density', and 'rarity' have a relative term, that is, a connotative term, in their nominal definitions.[39] Panaccio summarizes his two intermediate conclusions thus: ''connotative terms cannot always be seen as strictly synonymous with their nominal definitions'' and ''*there are simple connotative terms in Ockham's mental language*,'' leading to his principal conclusion:[40]

> His [Ockham's] nominalist theory of connotation, so crucial for his whole philosophical program, in no way requires the (impossible) elimination of relational terms. Their indispensability, on the contrary, is explicitly recognized and consistently taken into account.

In other words, Panaccio demonstrates that nothing in Ockham's theory commits him to the reductivist connotation-theory attributed to him by Spade and others. Ockham's nominalism relies heavily on connotation theory, connotation plays a central role in Ockham's analysis of the language of natural philosophy and mathematics, and the theory permits Ockham to deny the existence of any reality distinct from that of singular substances and qualities. Because connotation plays such a crucial role, why, Panaccio asks rhetorically, would anyone think that connotative terms and concepts are absent from the deep structures of mental language?[41]

Adams's earlier, promising conclusion bears emphasis here:[42]

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[36] Panaccio, 11.

[39] *Expositio super libros Elenchorum* 2.16, *OPh* III, 302.

[40] Panaccio, 20-1.

[41] Panaccio, 4. As Panaccio points out in his note 7, my *Physics* (n. 19 above) ''is particularly explicit about the central role of connotation in Ockham's analysis of the language of physics.''

[42] Adams (n. 21), 186. Note as well the observation by Boler (n. 13), 36, n. 37: ''Signification *conjunctim*...provides *inter alia* for the distinctions among the traditional Aristotelian categories which Ockham explicitly describes as differing not in *which* things they signify but in the *ways* they signify things...'' [emphasis added].

> It is not only which things (*res*) exist, but how they exist that may be—in many cases—prior to their being signified, whether naturally or by convention.

But the implication of that suggestion seems to be that some simple connotative terms do belong to the deep structure of mental language; indeed, that Ockham's program cannot guarantee the objectivity of things being co-specific, co-generic, related, quantified, active, passive, located in space and time, and so forth, without his connotation-theory, for these *ways* of being are prior to being signified, and Ockham's connotation-theory is an attempt to guarantee their objectivity without addition to *which* things exist, namely, substances and qualities.

1.4. Martin's Challenge

The project that remains, however, is more than an adequate analytic approach seems capable of delivering. The challenge was clearly laid down by Gottfried Martin in 1949, but it has been virtually ignored by Anglo-American authors, and it seems pointless to proceed without facing up to the fact that Martin's analysis and most of those dependent on it are inaccessible because written in German.[43] The entire book cannot be summarized let alone translated here, but a selective summary with translation of indispensable passages is requisite if the challenge is to be met.

The central point of Martin's analysis was to analyze Ockham's account of transcendental concepts and to determine their function in Ockham's ontology and semantics. It seemed to Martin that transcendental concepts are not only connotative but also fundamental for a complete understanding of Ockham's conceptualist program. The concepts on which Martin focused his study are 'unity', 'number', 'extension', and 'relation'. At the outset Martin expressed sensitivity to textual problems, especially limitations in the *Summa Logicae*, a text that often expresses Ockham's views in a very sketchy and introductory fashion, and hence Martin recognized the need to depend on the *Commentary on the Sentences* in order to support his analysis.[44] The central problem that drove Martin to his interpretation is stated early and clearly:[45]

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[43] See note 12. Inasmuch as my *Physics* was partly motivated by Martin's analysis, it follows that my study was incompletely understood. Mark Henninger, *Relations, Medieval Theories 1250-1325*, Oxford 1989, 119-45, recognizes the centrality of connotative concepts in Ockham's account of relation, yet, remarkably, Henninger leaves connotative terms and concepts unanalyzed. He does not even cite Spade's article, but he does cite Adams's book, and it does appear as if his analysis is in principle compatible with those of Spade, Adams, and Normore. On the other hand, Henninger does cite Martin's book and article, and perhaps even relies on Martin for one claim (131), but otherwise Henninger misses or ignores Martin's solution in terms of transcendentals, for example, p. 133. In any event, Henninger seems never to come to grips with Martin's interpretation.

> This study tries to show that the starting-point of Ockham's analysis is essentially the problem of unity. Ockham disputes the reality of quantity, relation, and of all the categories aside from substance and quality. According to the standard interpretation, the rejection of the reality of the last eight categories means that these eight categories are to be understood ontologically as mere conceptions, indeed as mere names.

Martin was aware, of course, of the centrality of the problem of universals, but he purposely defined his study in order to concretely verify the following thesis:[46]

> ...that Ockham's ontological standpoint on the problem of the being of the last eight categories, and especially of quantity and relation, should not be designated as "nominalism." Ockham rather designates the being of these categories as a transcendental being.

Martin supported this interpretation primarily by means of a comparison of the views of Ockham with those of Thomas Aquinas and Duns Scotus, specifically in the distinctions made by Thomas and Scotus between transcendental and accidental being. As we have seen, Ockham regards transcendental terms and concepts as connotative. It bears emphasis that generally among the scholastics and certainly in Scotus's hands, transcendental concepts refer to the "abstract but very real concepts that escape classification in the Aristotelian categories by reason of their greater extension and universality of application."[47] It was standard scholastic doctrine to distinguish between the transcendental notions of metaphysics and logic and to maintain that metaphysical, transcendental notions have reference to the order of reality and existence.[48] Starting out from the distinction made by Thomas and Scotus, Martin maintained that Ockham:[49]

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[44] *Ockham*, iv-v and 60-3.

[45] Ibid., vii-viii: "Die vorliegende Untersuchung versucht zu zeigen, daß Ockham wesentlich vom Problem der Einheit ausgegangen ist. Ockham bestreitet die Realität der Quantität und die Realität der Relation, er bestreitet die Realität aller Kategorien außer der Substanz und der Qualität. Die Bestreitung der Realität dieser acht letzten Kategorien würde nach der üblichen Auffassung bedeuten, daß diese Kategorien ontologisch als bloße Vorstellungen, ja als bloße Namen verstanden werden."

[46] Ibid., 8: "...daß der ontologische Standpunkt Ockhams im Seinsproblem der acht letzten Kategorien, insbesondere der Quantität und der Relation, nicht als Nominalismus bezeichnet werden darf. Ockham bestimmt vielmehr das Sein dieser Kategorien als ein transzendentales Sein."

[47] Cf. Allan Wolter, *The Transcendentals and their Function in the Metaphysics of Duns Scotus*, St. Bonaventure 1946, 1.

> ...questions the necessity of the distinction. Must one really distinguish, asks Ockham, between transcendental and accidental unity, transcendental and accidental number, transcendental and accidental relation? Is not the being of unity, number, and relation secured when understood as transcendental being?

As Martin pointedly and correctly emphasized, Ockham does not understand transcendental terms and concepts as mere names or terms:[50]

> Our analysis comes to the result that a completely nominalistic interpretation of transcendental being is not found expressly in Ockham.

Martin's challenge to a reductionist interpretation is clear. As for his "transcendental" interpretation, Martin recognized the need to explain how he was using the term, but we may remind the reader that Ockham himself regards properly transcendental terms and concepts such as 'one', 'true', and 'good' as connotative. In brief, it was Martin's contention that the possibilities for interpreting the beings to which connotative terms refer are real, accidental, merely conceptual, and transcendental. The principal point of Martin's study was to show that in view of Ockham's rejection of accidental being and of the merely conceptual reduction, Ockham was committed to the view that connotative terms refer to which things exist, as real, and to the ways in which things exist, as transcendental.

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[48] Ibid., 4.

[49] *Ockham*, viii-ix: "...er fragt aber dann nach der Notwendigkeit einer solchen Unterscheidung. Muß man, das wird Ockhams Frage, wirklich zwischen einer transzendentalen und einer akzidentalen Einheit, zwischen einer transzendentalen und einer akzidentalen Zahl, zwischen einer transzendentalen und einer akzidentalen Relation unterscheiden? Wenn auch die transzendentale Einheit, die transzendentale Zahl, die transzendentale Relation ein reales Sein im weiteren Sinne darstellen, bleibt dann die Realität von Einheit, Zahl und Relation nicht auch dann gesichert, so fragt Ockham, wenn man alle Einheiten, alle Zahlen, alle Relationen als transzendentale versteht?"

[50] Ibid., ix: "Unsere Untersuchung kommt zu dem Ergebnis, daß eine solche nominalistische Gesamtinterpretation des transzendentalen Seins sich bei Ockham nicht ausdrücklich vorfindet." In *Nominalismus* (n. 31) 47, Martin expressed the point thus: "Die Bestreitung des realen Unterschiedes [i.e. between a relation and its foundation] bedeutet also nicht die Bestreitung der Realität als solcher und die Bestreitung des realen Unterschiedes kann daher nicht als Nominalismus aufgefaßt werden. Versteht man die Relationstheorie Ockhams aus diesen systematischen und historischen Zusammenhängen, dann wird man die Angriffe Doncoeurs schwerlich gerechtfertigt finden. Es ist richtig: Ockham leugnet für die prädikamentalen Relationen den realen Unterschied zwischen der Relation und ihren Fundamenten. Aber Ockham leugnet damit nicht die Realität der prädikamentalen Relationen überhaupt, er versteht vielmehr die prädikamentalen Relationen seinsmäßig vom Sein der transzendentalen Relationen."

Ockham's view that the last eight categories and connotative terms do not refer to absolute accidents is universally acknowledged. The refutation of the completely reductivist analysis shows that Ockham was not only not a radical nominalist but also that Ockham did not intend to reduce all talk of being to *what* things exist—he was sensitive to the problem of the *ways* things exist.[51]

It might fairly be said that Martin was driven to his conclusion by the implausibility of reductivist interpretations. Does, for example, Ockham's denial of the reality of motion as an absolute thing or as an accident commit him to the view that motion is not real? Must we conclude that, according to Ockham, bodies do not really move? The implication is absurd on the face of it, but beyond that there are indications in Ockham's texts that his principles possess the resources to supply a more sensible interpretation.

As for what Ockham means by "transcendental being," Martin concluded that there are only two candidates and that they are not mutually exclusive: connotation and "*multae res.*" In the following quotation, the reader can see most clearly the relevance of Martin's work for my critique and, above all, for the contribution that he made (could have made, can still make) to our understanding of Ockham's theory of connotation:[52]

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[51] Ibid., 217. Spade, (n. 25), 606, offers a solution, though unavailable to Ockham, that makes Ockham's "doctrine of the categories obviously reminiscent of Kant's, insofar as in both theories the categories ultimately arise from the basic *forms of judgment*, the fundamental ways of combining concepts. Still, one would not want to push this analogy very far." Compare again with Boler's comment quoted above in note 42.

[52] Ibid., 251: "Ockham hat es für seine wichtigste ontologische Aufgabe gehalten, immer wieder zu zeigen, daß die Quantität und die Relation kein absolutes Sein darstellen.... Wenn Ockham die transzendentalen Kategorien als Weisen der Einheit versteht, so versteht er sie zugleich als Weisen des Seins, das heißt also als Weisen der Existenz. Diese Kategorien sind also für Ockham nicht mehr Klassen von Dingen, so wie es auch für Ockham noch die Substanz und die Qualität ist. Es gibt daher zwar Substanzen und Qualitäten nebeneinander, aber nicht Substanzen, Qualitäten und Relationen nebeneinander. Es gibt vielmehr für Ockham nur zwei Klassen absoluten Seins, die Substanz und die Qualität. Alle andere Kategorien sind keine neuen Dinge gegenüber der Substanz und der Qualität, sondern nur Weisen des Zusammenseins von Substanzen und Qualitäten. Wir können also die transzendentalen Kategorien für Ockham nicht nur als Weisen der Einheit, sondern auch als Weisen des Seins oder als Weisen der Existenz bestimmen."

> Ockham held it for his most important task in ontology to show repeatedly that quantity and relation do not represent absolute beings... When Ockham understands transcendental categories as ways of unity, he understands them simultaneously as ways of being, that is, also as ways of existing. These categories are thus for Ockham no longer classes of things such as substance and quality... There are for Ockham only two classes of absolute being, substance and quality. All other categories are not new things in addition to substance and quality, but rather ways in which substances and qualities exist together. Therefore, we can define transcendental categories according to Ockham not only as ways of unity, but also as ways of being or as ways of existing.

We must address an obvious problem with Martin's analysis, namely, the meaning of "transcendental" and the anachronism of referring to categories as "transcendental." The term "transcendental" is highly ambiguous. In its proper sense, it refers to concepts that are trans-categorical, that is, that fall outside of the Aristotelian categories. But inasmuch as Ockham considers the properly transcendental terms (except 'being') as connotative,[53] how can Martin interpret connotative terms, most of which are not the properly transcendental terms, as transcendental? There are clearly other senses of "transcendental" being employed here. Connotative terms either refer to *one thing understood in different ways* or *many things taken together or collectively*. Hence, "transcendental" is also meant to include terms that indicate *plural ways* or *plural things* and, accordingly, fall outside of any single category. This explanation is not intended to be exhaustive but merely to indicate that the ambiguity of "transcendental" as used by Martin is not fatal to his interpretation.[54]

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[53] Ockham, *SL* I. 38, emphasizes the special character of the term 'being', calling it "equivocal," predicable in "two senses," and "transcendental." Nevertheless, L. M. de Rijk, *Logic and Ontology in Ockham*, in: *Ockham and Ockhamists*, ed. E. P. Bos and H. A. Krop, Nijmegen 1987, 25-39, esp. 34-6, interprets 'ens' as "syncategorematic" and "absolute." Generally speaking, Ockham divides only categorematic terms into absolute or connotative terms. See Adams (n. 25) I, 319 and II, 958-60. Note how in the following text Ockham sets the term 'ens' between absolute terms and connotative terms without a clear indication as to which group 'ens' belongs. *SL* I. 11, p. 40, ll. 65-71: "Nomina autem primae intentionis vocantur omnia alia nomina a praedictis, quae videlicet significant aliquas res quae non sunt signa, nec consequentia talia signa, cuiusmodi sunt omnia talia 'homo', 'animal', 'Sortes', 'Plato', 'albedo', 'album', 'ens', 'verum', 'bonum' et huiusmodi, quorum aliqua significant praecise res quae non sunt signa nata supponere pro aliis, aliqua significant talia signa et simul cum hoc alias res." 'Ens' seems to be absolute when signifying God, substances, and qualities, but connotative when predicated of the other eight categories.

[54] Accordingly, J. A. Aertsen, *Ockham, ein transzendentalphilosoph? Eine kritische Diskussion mit G. Martin*, in: *Ockham and Ockhamists* (n. 53), 3-13, does not, in my view, adequately reflect the ambiguity of Ockham's analysis of the term 'ens' in *SL* I. 38; more-

Finally, however, it would be premature to propose a definitive resolution of the ontological problems generated by Ockham's theory of connotative concepts, nor can this summary do justice to the historical dimension of Martin's study. As suggested, an attempt focussing on transcendental concepts holds the greatest promise for success, but this is left as a challenge to analytic philosophers to either provide a better alternative or to work out the implications of such a suggestion that will satisfy their appetite for rigor and clarity. Certainly, the speculative character of Martin's suggestion and his Kantian reading of Ockham's doctrine are open to question; nevertheless, the reductivist interpretation of connotative concepts is demonstrably impossible. To conclude this section, I reformulate the challenge to understand Ockham's connotation-theory as presupposing ways of being prior to their being signified, and requiring the recognition that Ockham's ontology includes beings properly understood as ways of being as well as real beings.[55]

2. *Some Implications for Understanding the Natural Philosophy of the Fourteenth Century*

Much of the attention given to fourteenth-century natural philosophy has concentrated on ontological issues and the supposed conse-

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over, Aertsen does not adequately point out Martin's recognition of the fact that Ockham enumerates several transcendental terms among connotative terms (p. 224) and, finally, Aertsen does not sufficiently represent Martin's motivation and argument in behalf of a broader transcendental interpretation of connotative terms based on Ockham's rejection of reductive interpretations of connotation (216-20 and 228-34). I am grateful to Hans Thijssen for pointing out the papers by De Rijk and Aertsen and for providing me with copies of them. As indicated, I find their accounts of the term 'ens' inadequate and refer the reader to Adams, II, 958-60.

[55] Accordingly, studies based on Martin's view have also been incompletely understood. The most important example is the most comprehensive study of Ockham in any language, Jürgen Miethke's *Ockhams Weg* (n. 12), 139, 201-27 and 512-5. Cf. Philotheus Boehner, *Collected Articles on Ockham* St. Bonaventure 1958, pp. 20-1. See also Jan Beckmann, *Das Subjekt/Prädikat-Schema und die Frage nach der Möglichkeit von Metaphysik by Wilhelm von Ockham*, in: Franziskanische Studien, 59 (1977), 1-14, esp. 11-14. Note 1) Beckmann's suggestions to render properly transcendental terms and concepts as "transcategorical" and 2) his conclusion that predicability must have a ground, namely, a) there are individual beings and b) this individual being is free of contradiction. It should also be noted that Beckmann does not explicitly analyze properly transcendental concepts as connotative; however, an essay, Nihil scitum nisi complexum. *Von der Sach-zur Satzwissenschaft am Beispiel der Metaphysik*, in: *Miscellanea Mediaevalia* (forthcoming, 1993) may address further consequences of Ockham's treatment of transcendental concepts.

quences of realist-versus-nominalist starting-points. These connections are often stated in terms of the supposed logical consequences of a realist or nominalist ontology, but in my view the arguments making these connections are unpersuasive because the assumptions and conclusions are too narrow, implausible, and *prima facie* improbable. For instance, Ockham's denial of motion as an absolute entity has been taken to have consequences for his analysis of acceleration, for if motion is not an entity, then how can it undergo change?[56] The answer, of course, is that if motion is thought of as nothing more than a body's change of place over time, then the specific character of that change is a matter of accurately describing that change: uniform motion or some variety of non-uniform motion. From Ockham's point of view it is not the motion that is undergoing change, but rather a body that is undergoing a change of a certain kind.

2.1. Metalinguistic Analysis and Mathematics in Fourteenth-Century Natural Philosophy

This essay now shifts the focus to suggestions, following on John Murdoch and Amos Funkenstein, for a re-evaluation of fourteenth-century Aristotelian natural philosophy, suggestions that place less emphasis on ontological issues than they do on the meaning of the mathematical or functional or operational analyses provided by Aristotle and some of his fourteenth-century followers: Ockham, Thomas Bradwardine, and others associated with the so-called Merton School, William Heytesbury and John Dumbleton.

In a seminal article, John Murdoch shifted the discussion from ontological issues to the logical, semantical, and metalinguistic techniques developed especially in the fourteenth century. Murdoch pointed out how the metalinguistic treatment of connotative terms rendered such terms into sets of explaining propositions.[57] Murdoch went on to show how Ockham justifies the use of such fictive terms as 'point', 'line', and 'surface' without the least embarrassment. According to Ockham, mathematical terms and concepts are properly stated in conditional form. No knowledgeable mathematician declares that parallel straight lines extended to infinity never intersect, but rather formulates it thus: "If two parallel straight lines were extended to infinity, they would never meet." In other words, it is not necessary for mathematicians to suppose the real existence of such fictive entities in order to employ them usefully, for even a counterfactual treatment is of use to the mathematician, just as it has proved useful to the theologian.[58]

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[56] For example, Anneliese Maier, *Zwei Grundprobleme der scholastischen Naturphilosophie, Studien zur Naturphilosophie der Spätscholastik*, Volume 2, 2d ed., Rome 1955, 159-60; and James Weisheipl, *Ockham and Some Mertonians*, in: Mediaeval Studies, 30 (1968), 163-213.

[57] *Metalinguistic Analysis* (n. 12), 80-2. For three recent, important discussions of Aristotle's *Physics*, medieval Aristotelianism, and the transformations of Aristotle's arguments and of Aristotelianism in the Middle Ages, see Helen Lang, *Aristotle's Physics and Its Medieval Varieties*, Albany 1992; J. M. M. H. Thijssen, *Some Reflections on Continuity and Transformation of Aristotelianism in Medieval (and Renaissance) Natural Philosophy*, in: Documenti e studi sulla tradizione filosofica medievale, Rivista della

No one has been more insistent on the implications of Ockham's approach for theology and natural science than Amos Funkenstein.[59] Funkenstein recognized not only that mathematical notions are altogether connotative for Ockham, but also that connotative notions, though not without some foundation in reality, should not be hypostatized either. To Ockham as well as to some of the *Calculatores*, it was not necessary to view mathematics as an inventory of mathematical objects; they often took the view that only mathematical concepts or arguments that are necessary for the interpretation of nature are worthy of consideration, even when the application was dictated by formal considerations rather than empirical ones. The obscurity of the preceding sentence can be clarified by reference to the standard interpretation of Aristotle's dynamics, an alternative interpretation, and reflection on the meaning of Bradwardine's Rule.

2.2. Aristotelian Dynamics

To provoke fundamental re-examination, I begin with a rehabilitation of the Aristotelian analysis. Whatever the origin of the standard way, at least in pedagogical contexts, for representing Aristotle's account of motion, namely, $V \propto \frac{F}{R}$, there are statements from

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società internazionale per lo studio del medioevo latino, II, 2 (1991), 503-28; and Luca Bianchi and Eugenio Randi, *Le Verità dissonanti: Aristotele alla fine del medioevo*, Rome and Bari 1990 (Biblioteca di cultura moderna, 991).

[58] Murdoch (n. 12), 90-3. As for its use by the theologian in a variety of ways, see Eugenio Randi, *Ockham, John XXII and the Absolute Power of God*, in: Franciscan Studies, 46 (1986), 205-16.

[59] *Medieval Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century*, Princeton 1986, esp. 307-17.

Aristotle himself that render this formula a gross oversimplification and overgeneralization, but even if we take it as approximating what Aristotle had in mind, it still requires some modification.

Aristotle's conception of the relation between speed, force and resistance as presented in *Physics* VII was an intentional simplification of a more complex analysis. In *De Caelo* IV, chapter 6, Aristotle includes the shape of a body as a factor that accounts in part for the speed of a body. The context suggests that Aristotle intended the factor of resistance to include the density of the medium as well as the relation of the shape of the bodies moving and resisting. Hence, the standard formula—that velocity is directly proportional to force or weight and inversely proportional to the resistance of the medium—seems hardly adequate to express Aristotle's evidently more complicated notion. There are also practical considerations that make Aristotle's acceptance of the standard formula dubious.

Suppose that we compare two bodies of the same dimensions, one weighing 100 pounds and the other $\frac{1}{2}$ pound. According to the formula $V \alpha \frac{F}{R}$, the heavier body should fall 200 times faster than the lighter one in the same medium: $\frac{V_1}{V_2} \alpha (\frac{W_1}{W_2}) \times (\frac{R_2}{R_1})$, where $R_1 = R_2$. Then $\frac{V_1}{V_2} = \frac{W_1}{W_2}$. Since $\frac{W_1}{W_2} = \frac{100}{\frac{1}{2}} = 200$, then $\frac{V_1}{V_2} = 200$! If this does not seem persuasive, then consider a further consequence from the same example. Let us assume that in one second, the $\frac{1}{2}$-pound body falls one foot, then in the same second the 100-pound body would fall 200 feet! Or imagine the 100-pound body falling one foot, then in the same unit of time the $\frac{1}{2}$-pound body would fall only $\frac{1}{200}$ of a foot, nearly $\frac{1}{17}$ of an inch. Of course, it is possible that Aristotle never considered his supposed formula in such concrete terms. It may be that his commitment to common sense led him to take the general idea as incontrovertible, namely, that whatever the actual final velocity of a falling body may be, common sense tells us that its final velocity is dependent on the weight of the body and the resistance of the medium.

Let us return to the reminder that Aristotle's analysis applies to bodies moving, not in a void, but in a plenum. An appropriate metaphor for a medium filled with bodies is of a tank filled with water and some fish. In light of this metaphor there is a correspondence between Aristotelian theory and a fundamental phenomenon of fluid mechanics. The phenomenon involves objects moving through a fluid with a certain velocity. Physicists have determined a value known as a ''Reynolds number,'' which is the ratio of inertial forces to viscous forces. In Aristotelian terms we may regard viscous forces as the factors corresponding to resistance. When the ratio or Reynolds number is small, that means that viscous or resistance forces dominate. For our purposes the important consequence is that for two bodies of different mass moving through the same fluid medium, their velocities are directly proportional to their masses. If the Reynolds number for a man swimming in water is 10^4, for a goldfish 10^2, then for very small animals about a micron in size the Reynolds number would be as small as 10^{-5}. For such small animals, inertia is irrelevant, that is, for objects and media with a low Reynolds number, inertia plays no role whatsoever! The velocities of two bodies at very low Reynolds numbers are entirely determined by the forces exerted on them at that moment. The ratio of the velocities of the two bodies in the same medium is equal to the ratio of the forces acting on them. In Aristotelian terms, $V \propto \frac{F}{R}$! In addition, the continuous motion of a body at a low Reynolds number requires a continuous cause or the continuous exertion of a force. The case imagined is clearly a special case, but for that special case Aristotle's mechanical principles are generally correct. To be consistent, an empiricist would have to admit that Aristotelian mechanics is not false but true within a certain and limited domain of validity, which can be derived from the laws of classical mechanics![60]

Of course, the example indirectly stipulates what is wrong with the Aristotelian analysis, but even this requires a modification of the standard account. The Aristotelian analysis is not always wrong; the correction achieved by classical mechanics was of its generalization and application to bodies falling freely from rest through a relatively thin medium such as air.

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[60] See E. M. Purcell, *Life at Low Reynolds Number*, in: *Physics and Our World*, AIP Conference Proceedings, No. 28, ed. K. Huang, New York 1976, 49-64. If Lang (n. 57) is correct, however, then this analysis properly applies not to Aristotle's view but to the mechanics of the Aristotelian commentary tradition.

2.3. Mertonian Mechanics

The relevance of the above example to my analysis is at hand. Prior to Bradwardine's law, "forces could be represented as velocities or 'motions' directly, and an increase of force could be represented by a proportional addition or subtraction of lines representing motion."[61] Bradwardine criticizes the Aristotelian generalization as based on the false assumption that any force, however small, can move any resistance, however large, when, in fact, it is obvious that motion occurs only if the force is greater than the resistance. A true generalization, Bradwardine recognizes, must be valid for every variation of ratio, and it must either rule out the possibility of zero velocity or show that no motion arises only when the ratio of force to resistance is one to one. Expressed in modern form, he realizes that to double a velocity, the ratio of force to resistance must be squared. For example, if the ratio of force to resistance of a given motion is three to one, then to double the velocity the ratio of force to resistance must be squared, that is, increased to nine to one. Only the ratio squared can double the velocity, only the ratio cubed can triple the velocity, and so forth. Conversely, to halve the velocity the ratio of force to resistance must be reduced to the square root. For example, to halve the velocity of a body with a force-to-resistance ratio of nine to one, the force-to-resistance ratio must be reduced to three to one. Bradwardine's mathematical formula is valid for every variation of ratio, and it rules out the possibility of motion where the resistance is equal to the force, for, according to Bradwardine's law, the velocity of a body with a ratio of force to resistance of one to one is zero. In general form, Bradwardine's conclusion means that the velocity increases arithmetically as the ratio of force to resistance increases geometrically.

In other words and to the point, Bradwardine's law assumes that increments of velocity depend on an exponential increase of the ratio of force to resistance; hence, force can be represented only indirectly, for increase of force is measured by the rate of increase of velocity. It makes no matter that Bradwardine was a realist about 'motion'. It is absolutely clear that his analysis proceeds from the mathematics of ratios and not from some empirical, let alone experimental, falsification of the Aristotelian account; nevertheless, Bradwardine demonstrates the ability to state in a general form the medieval mathematics behind his function, and to use his analysis to correct the Aristotelian generalization.[62]

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[61] Funkenstein (n. 59), 311-2.

William Heytesbury and John Dumbleton did not share the ontological anxieties of Bradwardine or other fourteenth-century natural philosophers. Heytesbury is especially important for linking discussions and traditions that emerged out of the topical and sophistical literature of the twelfth and thirteenth centuries with developments in natural philosophy and mathematics. He based his discussions on foundations that derive from distinctions and techniques of logic and more explicitly on ontologically reductive assumptions in natural philosophy. In spite of a lack of attention to empirically complex cases, it was Heytesbury, of course, who contributed to the kinematical analysis of local motions the so-called Merton mean-speed rule: a moving body acquiring or losing velocity uniformly over a given period will traverse a distance equal to the distance it would traverse if it were moved continuously in the same period at its mean velocity. The rule was not applied to bodies falling from rest, nor was there any effort, so far as we know, to test it experimentally, rather did Heytesbury construct an account that seemed to meet the demands of logical coherence and conceptual clarity. In *De probationibus conclusionum tractatus regularum solvendi sophismata* (circa 1335), Heytesbury proves from the mean-speed theorem the consequence that in the second equal time interval the distance traversed by a body accelerating uniformly from rest will be three times the distance that it traverses in the first interval. A general form of this result states that in each interval the distances traversed by a body accelerating uniformly from rest will increase as the series of odd numbers beginning from unity, that is, 1, 3, 5, 7, and so forth.[63]

Heytesbury's reliance on Ockham in logic and natural philosophy for some basic notions has been acknowledged, however reluctantly, even by James Weisheipl.[64] It is sufficient to point out that Heytesbury's acceptance of Ockham's doctrines of substance, quality, motion, and time did not thwart his kinematical-mathematical analysis of local motion; the supposed negative consequences of the reductivist extremes of nominalist thinkers have obviously been exaggerated.

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[62] There are several reliable descriptions of Bradwardine's treatise, but the standard reference is the edition and translation by H. Lamar Crosby, Jr., *Thomas Bradwardine. His Tractatus de Proportionibus. Its Significance for the Development of Mathematical Physics*, Madison 1955. Incidentally, it should be remembered that James Clerk Maxwell's hypothesis of electromagnetic waves was demanded by the mathematics of his theory and not based on experimental evidence.

[63] Especially recommended are Curtis Wilson, *William Heytesbury: Medieval Logic and the Rise of Mathematical Physics*, Madison 1956, and Wilson's entry on Heytesbury in the *Dictionary of Scientific Biography*, Volume 6, New York 1972, 379-80.

Dumbleton, like Heytesbury, seems to have been a disciple of both Ockham and Bradwardine. More than Heytesbury, however, Dumbleton adheres openly to Ockham's doctrines, even though Dumbleton never cites Ockham by name. It is to Dumbleton that we owe the explicit clarification of Bradwardine's dynamical law, for Dumbleton expresses it as "the proportion of proportions," that is, the ratio of two velocities is treated as the exponent of the ratio of force to resistance: $\frac{F_2}{R_2} = (\frac{F_1}{R_1})\ V_2/V_1$. In Dumbleton's case there are some indications of interest in real cases and of linking his mathematics with his physics, yet it also seems to be the case that ontological commitments are minimal. In astronomy, Dumbleton believes that the geometry should reflect the actual motions of the heavenly bodies, yet in optics there is no indication of a commitment to the superfluous entities of "light metaphysics."[65] To Ockham and Dumbleton, the conclusion that visual rays are real entities does not square with Aristotle's qualitative analysis of light. On the other hand, it would be wrong to conclude that geometry has no function to perform in the analysis of light and vision. Dumbleton's basically Aristotelian conception of mathematical abstractions does not commit him to the view that all mathematical descriptions are referential or that they are all referential in the same way; some mathematical descriptions, like some concepts, are functional and utilitarian, and as connotative, mathematical concepts can be interpreted ontologically as referring to ways in which some objects exist. What is genuinely significant in Dumbleton's consideration of physical problems employing a mathematical analysis is that his approach is not Platonic—for Dumbleton the mathematics is not more fundamental than the physics even though his account suffers from limitations in both mathematical technique and empirical measurement.

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[64] Weisheipl's best study of the Mertonians is his unpublished doctoral dissertation, *Early Fourteenth Century Physics of the Merton 'School' with Special Reference to Dumbleton and Heytesbury*, Ph.D. dissertation, Oxford University, 1956, esp. 78-84.

[65] By far the most important studies of Dumbleton have been provided by Edith Sylla. Cf. Sylla, *The Oxford Calculators and Mathematical Physics: John Dumbleton's* Summa logicae et philosophiae naturalis, *Parts II and III*, in: *Physics, Cosmology, and Astronomy, 1300-1700: Tension and Accommodation*, ed. Sabetai Unguru (Dordrecht/Boston 1991 (Boston Studies in the Philosophy of Science, Volume 126); Sylla, *Medieval Quantifications of Qualities: The 'Merton School'*, in: Archive for History of Exact Sciences, 8 (1971), 9-39, esp. 13-27.

That the mathematization of physics that occurred in the seventeenth century was more empirical and less dominated by idealized mathematics is now something of a commonplace, but the undue focus on ontological questions has obscured the service performed by fourteenth-century logicians and natural philosophers in shifting attention from mathematics as mere discussion about objects and entities to mathematics as a language, "a symbolic formalism capable of many interpretations."[66] Little wonder, then, that mathematical formalism and metalinguistic formalism came to be applied to all disciplines including theology. If mathematics is primarily thought of as a language and not as a category of beings, then the prohibition against using mathematics to represent other categories of being loses its force.

2.4. The Mathematical Foundations of Medieval Polyphony and Ars Nova

Funkenstein's observation about mathematics in the fourteenth century is confirmed by a development that he did not even consider.[67] Indeed, this is an area of the quadrivium that has been relatively neglected by scholars, and it is ironically the one area where we do possess evidence of theoretical responses to empirical or, at least, practical developments.[68] The story is complex, but here we can find some evidence of reconsideration of mathematical ideals. The dilemmas provoked by developments in medieval polyphony and in *ars nova* seem to have been excruciatingly painful. Even the innovative responses indicate how hesitant fourteenth-century thinkers were to question standard theory, yet several authors did so, and however exceptional or insecure they may have been, they provide a glimpse of the modern interpretation of mathematics and of the regulation of mathematics by experience. Only a brief summary and reference to the principal texts and innovations are indicated here:[69] Boethian theory in the Middle Ages, some of the innovations in polyphony and *ars nova*, and the reactions of Walter Odington, Johannes de Muris, and Nicole Oresme.

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[66] Funkenstein (n. 59), 312-14.

[67] Even in this respect, however, Funkenstein, 312-5, recognized the new style of mathematical reasoning of the fourteenth century whereby some mathematicians became aware of the discrepancy between simple theory and the complexity of actual analysis.

[68] Notable exceptions are John Murdoch, *Music and Natural Philosophy: Hitherto Unnoticed* Questiones *by Blasius of Parma(?)*, in: Manuscripta, 20 (1976), 119-36; Jamie Kassler, *Music as a Model in Early Science*, in: History of Science, 22 (1982), 103-39; V. Zoubov, *Nicole Oresme et la musique*, in: Mediaeval and Renaissance Studies, 5 (1961), 96-107; and Eric Werner, *The Mathematical Foundation of Philippe de Vitri's* Ars nova, in: Journal of the American Musicological Society, 9 (1956), 128-32. Although David Lindberg mentions Boethian theory, his recent survey completely ignores musical developements in the thirteenth and fourteenth centuries and the reactions that they provoked among mathematicians and natural philosophers. See Lindberg, *The Beginnings of Western Science*, Chicago 1992.

Boethian theory is primarily Pythagorean. According to Pythagorean tuning, only simple number ratios are legitimate (in the form of a ratio a:b which is either a) a whole number, or b) a fraction that equals $\frac{n+1}{n}$, the so-called "superparticular" ratio). As a consequence, the Pythagorean system tends to rigidity, and this rigidity is extended to the acceptance of only three ratios as consonant: the octave (2:1), the fourth (4:3), and the fifth (3:2). In Pythagorean tuning, the third is represented by the ratio 81:64 (the product of two whole tones $\frac{9}{8} \times \frac{9}{8}$), lying between the just major third and the perfect fourth and not as pleasant sounding as the just major third (5:4). Until polyphony became more widespread, the Pythagorean system remained satisfactory, but polyphonic music led to greater use of thirds and sixths. In addition, more complex rhythms were introduced. These developments in musical practice tended to drive a wedge between academic, mathematical theory and musical practice, and as a result musical practice diverged from mathematical theory.[70] In other words, academic mathematicians were reluctant to modify theoretical ideals even if incompatible with practice, but there were notable exceptions.

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[69] This summary is dependent on a lenghtier and more detailed paper, *Music as Art and Science in the Fourteenth Century*, in: *Miscellanea Mediaevalia* (1993, forthcoming).

[70] For details and qualifications, cf. Boethius, *Fundamentals of Music*, tr. Calvin Bower, New Haven/London 1989, xx-xxix; Hugo Riemann, *Geschichte der Musiktheorie im IX.-XIX. Jahrhundert*, 2d ed., Berlin 1920, Book II; Edward Lippman, *The Place of Music in the System of Liberal Arts*, in: *Aspects of Medieval and Renaissance Music*, ed. Jan LaRue, New York 1966, 545-59; and Theodore Karp, *Music*, in: *The Seven Liberal Arts in the Middle Ages*, ed. David Wagner, Bloomington 1983, 169-95.

Around 1300, Walter of Odington wrote a musical treatise, *De speculatione musicae*, which mentions the common use of major sixths and, more importantly, observes that major and minor thirds were intuitively tuned by human voices in the ratios of 5:4 and 6:5 instead of the ratios given by the Pythagorean monochord (81:64 and 32:27).[71] It was clear to Walter that major and minor thirds are not necessarily dissonant. The more frequent use of sixths suggests that the late medieval ear was becoming attuned to previously unacceptable intervals. The importance of this shift cannot be overemphasized. The introduction of thirds and sixths as consonances is indispensable for the introduction of harmonic chords with a tonic (for example, the C-E-G chord of the C-major scale). Walter may have been influenced by a Welsh predilection for major and minor thirds; in any case, the practice is consistent with the observation that fourteenth-century composers were more concerned than earlier composers, relatively speaking, with the sonority or ''vertical'' dimension of their music. This point can be exaggerated, for resolution was still dominated by fourths and fifths; nevertheless, the use of thirds and sixths in accented places and not just in intervals of short duration and occasionally even in the final chord of a piece indicates a growing tolerance for thirds and sixths without the need to resolve them.[72]

The problem for musical theory was how to account for these new consonances so that they could be fully integrated into musical theory. The process went on for over a century and a half. Although familiar in academic circles, the new style of composition of the fourteenth century, the *ars nova*, was not compatible with the rigid principles of

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[71] I have consulted the following editions: *Scriptorum de Musica Medii Aevi*, ed. C. E. H. Coussemaker, Volume 1, Paris 1864, 182-250 and *Summa de speculatione musicae*, ed. Frederick Hammond, *Corpus Scriptorum de Musica*, Volume 14 (n.p.: American Institute of Musicology 1970). The relevant text where Walter treats the third as consonant appears in Part II: Coussemaker, 198-9; Hammond, 69-70: ''In qua proportione numerorum sint ditonus [major third] et semiditonus [minor third] et utrum sint symphoniae... Verumtamen quia vicinae sunt sesquiquartae [5:4] et sesquiquintae [6:5] habitudinibus quarum unitas facit differentiam, idcirco plurimos estimant consonas esse. Et si in numeris non reperiantur consoni, voces tamen hominum sua subtilitate ipsos ducunt in mixturam suavem et penitus in consonum quandoque dulcedine nota fit suave et consonum, in vocis ruditate offendit auditum.'' Brackets added.

[72] Cf. H. F. Cohen, *Quantifying Music*, Dordrecht/Boston 1984, 3-4, 46, and 250-9.

Pythagorean theory, and as a consequence it generated a crisis in academic theory. In *ars nova*, musical practice departed radically from rigid Pythagorean ideas in both harmony and rhythm, driving Pope John XXII to distraction.[73] The introduction of polyphony and in the thirteenth century of the so-called *hoquetus* (the division of a line between two voices by singing its individual notes in rapid alternation) became characteristic of *ars nova* in the fourteenth century. Prior to the appearance of polyphony, western music had a distinctly horizontal character to it marked by a single melodic line composed principally in triple meter. Accordingly, intervals were created successively and not simultaneously. The evidence shows that the composition of early polyphony was successive, that is, beginning with one line and adding the other lines successively. Hence, early polyphony is still horizontal in character because each voice is an independent line, but since these were sung together, simultaneous intervals were also produced. The result, as suggested, was the use of intervals regarded as illegitimate by Pythagoreans and the appearance of more complex rhythmic patterns generated by the introduction of duple meter and the *hoquetus.*[74]

The rhythmic developments of *ars nova* are usually considered to be its most important innovation. Around 1260, Franco of Köln's *Ars cantus mensurabilis* introduced a system of notation with a set of rules that summarized the rhythmic conventions of *ars antiqua.* One of the most important features of Franco's system is the distinct preference for triple meter, a preference that was due to the belief that the number 3 is a symbol of perfection. In fact, Franco did not admit duple meter. Consequently, even binary modes were altered to make them conform in the notation to triple meter. One of the consequences of successive composition of early polyphonic motets was greater rhythmic independence of the parts. This feature was reinforced by the increasing popularity of the *hoquetus* or hocket. It was especially the importation of this technique into sacred music that so unsettled Pope John XXII.[75]

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[73] Cf. Johannes XXII, *Extravagantes Decretales* (Extravagantes Communes), Lib. III, Tit. I, De Vita et Honestate Clericorum, Cap. un., *Corpus Iuris Canonici*, ed. A. L. Richter and A. Friedberg, Pars II, Decretalium Collectiones, Leipzig 1881, columns 1255-1257. See also Alec Harman, *Medieval and Early Renaissance Music, Man and his Music*, Volume 1, New York 1969, 122-4.

[74] See, for example, Harman, 109.

[75] Compare Harman, 49-50, 113-25 with Albert Seay, *Music in the Medieval World*, 2d ed., Englewood Cliffs 1975, 109-23.

The two principal innovations of *ars nova* can be expressed as ending the dictatorship of Pythagorean harmony and triple meter. The result was the more frequent appearance of thirds and sixths and a far greater variety of rhythm. Philippe de Vitry, one of the founders of *ars nova*, admitted duple and triple meter and even the use of both meters in the same piece. In the face of rhythmic anarchy, the composers of *ars nova* developed a rhythmic structure known as isorhythm, the division of a voice or voices into identically repeated rhythmic patterns, which provided a means of unifying a motet.[76]

The incorporation of these ideas and the problems that they generated into the medieval university curriculum may not have been typical, but there is significant evidence, however exceptional, of a profound impact on mathematics and natural philosophy.[77] There was evidently much opposition to the innovations, which seem to parallel other disputes involving mathematical and philosophical analyses of quality, quantity, continuity, and motion.

In his *Notitia artis musicae* of 1321, Johannes de Muris addressed problems of notation generated by the metric innovations of *ars nova.* Johannes was known primarily as an astronomer, but he was a friend of Philippe de Vitry and, evidently influenced by Philippe, took an interest in the problem of notation from the point of view of the division of notes into their smallest possible measures. Johannes himself makes the context and his view about the relation of theory and practice clear:[78]

> Nos autem propter bonum commune et ratione veritatis, quae diu latuit, ostendendae circa artem musicae proponimus vigilare, intendentes circa eam duo breviter enodare: primo theoricam, secundo practicam, cui non est inconveniens quodammodo quamdam theoricam implicari.

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[76] Cf. Harman, 123-9 and Seay, 129-36. On isorhythm, see *Die Harmonik der Ars nova*, Zur Theorie der isorhythmischen Motette, Berliner Musikwissenschaftliche Arbeiten, ed. Carl Dahlhaus and Rudolf Stephan, Volume 5, München 1973. On Philippe, see Ernest Sanders, *The Early Motets of Philippe de Vitry*, in: Journal of the American Musicological Society, 28 (1975), 24-45. In general on *ars nova*, see Edward Lowinsky, *Music in the Culture of the Renaissance*, in: Journal of the History of Ideas, 15 (1954), 509-53.

[77] The evidence is literally outstanding even if not typical. See, for example, Nancy Siraisi, *The Music of Pulse in the Writings of Italian Academic Physicians (Fourteenth and Fifteenth Centuries)*, in: Speculum, 50 (1975), 689-710.

[78] See the indispensable study by Max Haas, *Studien zur mittelalterlichen Musiklehre I: Eine Übersicht über die Musiklehre im Kontext der Philosophie des 13. und frühen 14. Jahrhunderts*, in: *Aktuelle Fragen der Musikbezogenen Mittelalterforschung*, Forum Musicologicum, Basler Beiträge zur Musikgeschichte, Volume 3, ed. Hans Oesch and Wulf Arlt, Winterthur 1982, 323-456, esp., 395.

The connection between the theoretical and the practical, between the universal and the experiential is used by Johannes to assert that while a continuum is infinitely divisible, in natural things, such as a musical tone, there are necessarily natural limits to magnitude and divisibility, that is, a maximum and a minimum. If the maximum is designated as 1, then the minimum (the smallest possible division of a tone) is $\frac{1}{81}$ of the maximum. The technical significance of this text will shortly be made clear, but the immediately relevant point is that Johannes legitimates so-called imperfect relations in contrast to conservative academicians, like Jacques de Liège, who continued to insist on essential perfection and on the priority of mathematical theory over actual experience.[79]

The technical limitations of Johannes's analysis may have already been noticed by Philippe de Vitry who seems to have been concerned with the mathematical soundness of *ars nova* practice. Notice the difference in the concern: not a matter of saving the prevailing theory but rather of discovering or inventing a mathematically sound theory justifying the practice. Philippe apparently asked Gersonides for a demonstration of the musical postulate, whether all pairs of harmonic numbers are mathematically distinguishable except the following: 1 and 2,2 and 3,3 and 4,8 and 9. A harmonic number is defined as any number divisible down to unity by 1,2, or 3, and whose factors are also divisible down to unity. When Philippe introduced duple time on an equal footing with triple time, it was thought that the largest possible number of *minimae* was 81 (3^4), and the smallest number was 16 (2^4). This was, in fact, the conclusion to which Johannes de Muris had come. What Gersonides, then, had been asked to prove was whether, with the exception of the pairs 1 and 2,2 and 3,3 and 4,8 and 9, the numbers that are powers of 2 and 3 and their corresponding products differ from one another by more than unity. With such a proof, it would not be necessary to examine each case individually, for the result would be a mode of division extending over the entire number system beyond the previous limit of 81. What Gersonides proved is that "duple and triple time, respectively, can be recognized in each mensural unit" and that "the sum total of the smallest units determines for each case *one and only one* basic mode of division.''[80] In modern mathematical terms, for all multiples of the powers of 2 and 3 beyond the numbers 8 and 9,

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[79] For details, see Haas, 393-408. On Jacques de Liège, see his *Speculum musicae, Scriptorum*, ed. Coussemaker (n. 69), Volume 2, Paris 1867, 193-434.

if m and n are integers,
and if $m>1$ and $n>2$, then $3^m+1\neq 2^n$;
and if $m>2$ and $n>3$, then $3^m-1\neq 2^n$.[81]

Musicologists are agreed on the importance of this proof for the development of musical notation and on the effect that the mathematical discussions had on the development of western music:[82]

> Thus it was the mathematicians who opened the way and created the notational means for the whole vast development of rhythmic and poly-rhythmic figurations in Western music.

No less a figure than Nicole Oresme, also a friend of Philippe de Vitry, was familiar with this proof. In *Le Livre du ciel et du monde*, Oresme presented the result in the form of a table that makes it entirely clear:[83]

1	2	4	8	16	32
3	6	12	24	48	
9	18	36			
27	54	108			
81					
243					
729					

Finally, we should not overlook passages where Oresme indicates a preference for practice over theory:

> Item, aussi comme mutacion ne peut estre que elle ne soit en miex ou en non-miex combien que aucune fois tout ensamble soit tres bien, si comme un chant de pluseurs voiez tres bon ne seroit pas si bon se les voies estoient tousjours ou tres meilleur acort, samblablement selon la variacion de la musique insensible du ciel les choses ce cibas sont une fois en meilleur disposicion que en autre,..[84] Adhuc autem alia via procedemus. Que est ista cantilena que placeret sepe aut

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[80] My summary follows closely and is almost entirely dependent on Werner (n. 68), 128-32.

[81] Werner, 131.

[82] Lowinsky (n. 76), 543.

[83] Adapted from the edition of Albert Menut and Alexander Denomy (Madison 1968), 479, figure 29.

[84] Ibid., 482.

> multotiens repetita? Nonne talis uniformitas gignit fastidium? Ymo certe, et novitas plus delectat. Nec esset reputatus cantor optimus sed cuculus, qui non posset modulos musicos variare qui sunt variabiles in infinitum.[85]

In both texts Oresme, clearly aware of the incompatibility between the simple arithmetical theory of the Pythagorean system and the aesthetically more pleasing variation of consonances and rhythms, recognizes the delight that we take in change and variation. Oresme does not reject Pythagorean harmony, but in allowing the ear to be the final arbiter of aesthetic judgment of musical sounds, he does in fact depart from Pythagorean theory.[86]

Again, the point of this seeming digression is that theorists inclined to let practice adjudicate questions of value were admitting mathematical principles that conform to practice rather than allowing theoretical principles to dictate practice. The insistence on simple numerical ratios and proportions had dictated musical composition and practice, but in the fourteenth century *ars nova* challenged mathematicians to discover or construct the principles that conform to the new harmonies and rhythms. Clearly in such contexts, the conception of mathematics as a language superseded ontological considerations. Although no composer and no theorist of the fourteenth century could bring himself to state the conclusion explicitly, some had implicitly come to the conclusion that the ratios of Pythagorean harmonic theory are not privileged.

3. *Conclusion*

The "rehabilitation" of Aristotelian mechanics suggested above may seem fanciful, but perhaps it seems less so when read in conjunction with developments in medieval musical theory. The changes that occurred in mathematical analysis in the fourteenth century were not decisive, yet they constituted a challenge to prevailing academic theory and as such sustained anomalies that provoked later programs. When the Aristotelian analysis fell before another agenda that superseded it, adherents of Aristotelianism understandably overreacted, thus obscuring even more the subtle effects of corrections of Aristotle within the Aristotelian tradition. Seen properly, classical mechanics did not refute Aristotelian mechanics, rather it superseded it by achieving a new generalization and simplification that completed the process of correction of Aristotle by correcting the false generalizations of Aristotelian mechanics. There is a difference between the claim that Ptolemaic hypotheses are empirically false and the claim that Pythagorean harmonic theory and Aristotelian mechanics are true within a domain of application more restricted than Pythagoreans and Aristotelians realized.

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[85] *Tractatus de commensurabilitate vel incommensurabilitate motuum celi*, ed. Edward Grant, *Nicole Oresme and the Kinematics of Circular Motion*, Madison 1971, 316.

[86] The implications for the theory of acoustics are elaborated in *Music* (n. 69). See Kassler and Zoubov (n. 68).

Metalinguistic analysis of the fourteenth century, whether inclined to realism or nominalism, attempted to correct Aristotle within a basically Aristotelian framework. It is not surprising that it took the adoption of a new framework, the Copernican, to realize the fulfilment of that process of correction. Ockham's account of connotative concepts represents one effort among others to replace putatively superfluous ontological commitments with expressions or paraphrases that indicate the required and appropriate ontological commitments and the conditions of substances and qualities that obtain prior to their being signified. Mertonians who were satisfied with Ockham's ontological commitments included mathematical formulas and expressions as part of a metalinguistic approach to philosophical and theological problems. There is no single, complete, or pervasive application of these ideas in the fourteenth century, but there are indications of a shift in the interpretation and application of mathematics, and hence a connection with later developments in acoustics, astronomy, and mechanics.

The standard reductivist interpretation of Ockham's connotation-theory has been overreductionistic and hence damaging to the effort to understand Ockham and, accordingly, the place and meaning of his efforts in fourteenth-century natural philosophy. The time to abandon overreductionistic assumptions in the reading of Ockham's theory of connotation is long overdue. As Panaccio has incisively put it, the range of connotative terms is rich and economical, and the same judgment holds for metalinguistic techniques in fourteenth-century natural philosophy.

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Vivarium XXXI, 1 (1993) ©E.J. Brill, Leiden

Roger Bacon and the Hermetic Tradition in Medieval Science

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Roger Bacon would no more have wished to be called a Hermeticist than to be called a magician. For him magic was by its very nature bad, but this did not stop him from indulging beliefs and practices that bordered on the magical. Similarly, although he had no great or very favourable image of Hermes Trismegistus, his writings are infused with a spirit akin to what in a loose understanding of the term have been called Hermetic trends in Renaissance thought, and especially to the ''Hermetic Tradition in Renaissance Science''.[1]

In exciting scholarship dating back some thirty years and more, a group of scholars, some closely associated with the Warburg Institute in London, demonstrated the vitality in Renaissance thought of quasi-magical traditions associated (sometimes rather remotely) with writings attributed to the supposed ancient Egyptian sage Hermes Trismegistus, and urged their importance for a proper historical assessment of the nascent Scientific Revolution.[2] The impact made by these studies has produced the impression that ''Hermetic'' influences upon science were in essence a Renaissance phenomenon and had negligible medieval precedents. The aim of the present article is to help redress the balance, and, while by no means denying Renaissance originality, to show that important ideas now often regarded as characteristically Renaissance, were very much alive in the Middle Ages. To this end I shall consider two facets of the work of Roger Bacon: the role that he ascribed to *prisca auctoritas*, or ancient authority, and his attempt to naturalise some apparently magical practices by means of the doctrine of multiplication of species.

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[1] The phrase is from Frances A. Yates' oft-cited article, *The Hermetic Tradition in Renaissance Science*, in: *Art, Science, and History in the Renaissance*, ed. Charles S. Singleton, Baltimore 1968, 255-74, reprinted in F. A. Yates, *Ideas and Ideals in the North European Renaissance: Collected Essays, Volume III*, London 1984, 227-46.

[2] Among important writings in this genre, together with some more critical of it, I cite here: F. A. Yates, *Giordano Bruno and the Hermetic Tradition*, London 1964; *id., The Rosicrucian Enlightenment*, London 1972; D. P. Walker, *Spiritual and Demonic Magic from Ficino to Campanella*, London 1958; *id., The Ancient Theology: Studies in Christian Platonism from the Fifteenth to the Eighteenth Century*, London 1972; C. B. Schmitt, *Perennial Philosophy: from Agostino Steuco to Leibniz*, in: Journal of the History of Ideas, 27 (1966), 505-32, reprinted in Schmitt, *Studies in Renaissance Philosophy and Science*, London 1981; P. Rossi, *Francis Bacon: From Magic to Science*, tr. S. Rabinovitch, London 1968 (originally published in Italian 1957); P. J. French, *John Dee: The World of an Elizabethan Magus*, London 1972; N. H. Clulee, *John Dee's Natural Philosophy: Between Science and Religion*, London 1988; J. E. McGuire & P. M. Rattansi, *Newton and the 'Pipes of Pan'*, in: Notes and Records of the Royal Society of London, 21 (1968), 108-43; R. S. Westman & J. E. McGuire, *Hermeticism and the Scientific Revolution*, Los Angeles 1977.

1. *Prisca Auctoritas*

The role of things ancient—I adhere to this translation against Schmitt's preferred "venerable"—in Renaissance thought has been well summarised by the late Charles B. Schmitt in an article centred on Agonisto Steuco:

> The word *priscus*, probably best translated as "venerable", is one which recurs often in Steuco. He speaks of *priscis saeculis*, in former centuries, *prisci philosophi, prisca philosophia*, and *prisci* alone, referring to "the venerable philosophers and theologians". None of this is accidental. Truth flows from a single fountain, as it were, but is manifested in various forms. Moreover, the revelation of truth dates back to the most ancient times, to the *prisca saecula*, and we can find truth in the writings derived from this period. The wisdom of earliest times is then transmitted to the later centuries, truth and wisdom being as old as man himself.[3]

But, for all its other virtues, Schmitt's article paid scant attention to the Middle Ages. In like vein D.P. Walker, after discussing the fortunes of what he called Ancient Theology in the early Christian period, continued, "When in the Renaissance the Ancient Theology was revived..."[4] It is as if Renaissance scholars were launching a counter-attack to the "revolt of the medievalists"[5] which would have antedated many of the Renaissance's more traditional virtues, and staking a claim for originality, or rather genuine rebirth, in this less familiar and *prima facie* rather "irrational" territory. But here again their claim must be modified, as I hope that the example of Roger Bacon will demonstrate.

The phrase *prisca auctoritas* occurs in the opening passage of

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[3] Schmitt, *Perennial Philosophy*, 520.

[4] Walker, *Ancient Theology*, 2.

[5] To use the phrase of Wallace K. Ferguson, *The Renaissance in Historical Thought*, Cambridge, MA 1948, ch. 11.

Boethius's *Arithmetica*, which was often quoted by medieval scholars, including Bacon himself:

> Among all men of ancient authority (*priscae auctoritatis*), who with Pythagoras leading blossomed with a purer frame of mind, it was manifestly established that scarcely anyone could attain the summit of perfection in the disciplines of philosophy who did not pursue such nobility of prudence by a sort of quadruvium or fourfold way, which will not escape the awareness of the correctly contemplating.[6]

This passage was applied towards establishing the absolute necessity of mathematics in other branches of learning, but for Bacon the notion of *prisca auctoritas* was also firmly embedded in an elaborate, sophisticated and untidy epistemological structure, closely allied to theological concerns.

In a sense, all knowledge for Bacon was contained in the Scriptures, whence it should be elicited by the aid of philosophy and canon law. But these themselves had to come from somewhere, and so Bacon placed rather more emphasis on an initial revelation to the patriarchs and prophets near the beginning to time:

> I say then that the power of philosophy was given by God to the same people as Holy Scripture, namely the saints from the beginning, so that there should thus appear to be one complete wisdom necessary to men, for only the patriarchs and prophets were true philosophers who knew all things, that is not only God's Law but all parts of philosophy, for Holy Scripture itself shows us this clearly enough, which says that Joseph taught prudence to Pharaoh's princes and the elders of Egypt, and that Moses was skilled in the whole wisdom of the Egyptians.[7]

Accordingly transmission becomes of crucial importance, and Bacon produced an elaborate genealogy of knowledge. For the earlier period Josephus was an invaluable source of reference, from whom it could be gathered that Noah and his sons taught mathematical sciences to the Chaldeans, and Abraham to the Egyptians.[8] Later on Augustine provided profuse and detailed aid, and his euhemeristic tendencies[9] meant that Bacon's account includes many gods, for example, Isis, Minerva and Apollo, as inventors and transmitters of the arts.

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[6] A. M. T. S. Boethius. *De institutione arithmetica* I. 1, ed. G. Friedlein, Leipzig 1867, 7. Cf. *The "Opus Majus" of Roger Bacon*, ed. J. H. Bridges, Oxford 1897-1900, I, 98; *Communia Mathematica Fratris Rogeri*, ed. R. Steele, *Opera Hactenus Inedita Rogeri Baconi*, XVI, Oxford 1940, 8.

[7] *Opus maius*, ed. Bridges, III, 53-4.

[8] *Antiquities* I. 8. The Latin translation of Books I-V is edited in F. Blatt, *The Latin Josephus. V. I: Introduction and Text: The Antiquities I-V*, Copenhagen 1958.

[9] Cf. J. Seznec, *The Survival of the Pagan Gods: The Mythological Tradition and its Place in Renaissance Humanism and Art*, New York 1961, 11 sqq.

As we shall soon see, the process of transmission was not immaculate, and for this reason among others Aristotle held a pivotal position:

> He cleared away the errors of preceding philosophers and increased philosophy, aspiring to the fullness that the ancient patriarchs possessed, although he could not perfect the particulars, for later people corrected him in some things and added many things to his works, and moreover they will be added to until the end of the world, because nothing is perfect in human findings, as was expounded above. Nature strengthened him, as Averroes says in Book III of *On the Soul*, so that she would effect the ultimate perfection of a man.[10] By the testimony of all great philosophers he surpasses [other] philosophers, and there is to be ascribed to philosophy only what he asserted. Thus at the present time as regards philosophy's authority, he is antonomastically named Philosopher, just as in the teaching of sacred wisdom Paul is understood by the name Apostle. But whether on account of the hiddenness and rarity of exemplars, or of difficulty, or of envy, or of wars in the East, Aristotle's philosophy lay quiet and silent for the most part until after the times of Muhammad, when Avicenna, Averroes and others recalled it to the light of full exposition.[11]

This passage indicates an adulation for Aristotle that almost matches that displayed by Averroes. And for Bacon an especially important work of Aristotle's was the *Secretum Secretorum*, whose author had the virtue of backing up Bacon's view of the original revelation of knowledge in a passage that Bacon enthusiastically quotes:

> God revealed all wisdom to his prophets and just ones, and some others whom he preelected and illumined with the spirit of divine wisdom, and he endowed them with the gifts of knowledge. From these, succeeding philosophical men had the principle and origin of philosophy, Indians, Latins, Persians, and Greeks, for from them they had and wrote down the principles and secrets of the arts and sciences, because in their writings is found nothing false, nothing rejectable, but all approved by the wise, for the philosophers had all things from them, and especially the Greeks, because they were the more studious.[12]

In his discussion of Aristotle, as elsewhere in his writings, Bacon seems to come close to affirming the idea of scientific progress,[13] but this was always in strong tension with the reality of decline, which followed almost inevitably from his epistemological scheme and the doctrine of the Fall of man:

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[10] Averroes, *Commentarium Magnum in Aristotelis De Anima Libros*, ed. F. Stuart Crawford, Cambridge, MA 1953, 433: "Credo enim quod iste homo [Aristoteles] fuit regula in Natura, et exemplar quod Natura invenit ad demonstrandum ultimam perfectionem humanam in materiis."

[11] *Opus maius*, ed. Bridges, III, 66.

[12] *Opus maius*, ed. Bridges, III, 54. Cf. *Secretum secretorum, cum Glossis et Notulis. Tractatus brevis et utilis ad declarandum quedam obscure Dicta Fratris Rogeri*, ed. R. Steele, *Opera hactenus inedita Rogeri Baconi*, Fasc. V, Oxford 1920, 64. The last part of the quotation, "for the philosophers ... studious" is due more to Bacon than to pseudo-Aristotle.

[13] On this cf. A. G. Molland, *Medieval Ideas of Scientific Progress*, in: Journal of the History of Ideas, 39 (1978), 561-77, espec. 567-71.

> On account of the wickedness of men who abused the ways of wisdom, as first Nimrod and Zoroaster and Atlas and Prometheus and Mercurius Trismegistus and Aesculapius and Apollo and Minerva and the like, who were honoured like gods on account of wisdom, God darkened the foolish heart of the multitude, and the practice of philosophy gradually declined until Solomon recalled it again and altogether perfected it, as Josephus teaches in the eighth book of the *Antiquities*. And once again on account of men's sins the study of wisdom gradually disappeared until Thales of Miletus resumed it and his successors expanded it, while Aristotle completed it so far as was possible for that time. But they learnt all things from the Hebrews, as Aristotle says in the *Book of Secrets*, as was expounded above.[14]

Thus the general position is that decline was inevitable, but could still be resisted, and Bacon, in a frequently repeated schema, sees three occasions on which resistance was especially successful. The first was with Solomon, and the second with Aristotle; the third was to be ascribed to Avicenna, who for Bacon was Averroes' superior and the chief expositor of Aristotle. "In this way philosophy was four times delivered up sufficiently, but twice altogether complete, namely first by the sons of Adam and Noah, and secondly by Solomon. The other two delivered it sufficiently for their times, but they did not altogether complete it, because they were infidels."[15] Bacon was adamant that it had not yet been similarly restored among the Latins, and there are strong hints that he saw himself as the man to perform this task, and, given that he was not an infidel, this would surely make him the rival of Solomon.

The question was how to do it, and for this Bacon offered a variety of strategies. One was the way of scholarship. Bacon said of his own efforts in establishing the genealogy of knowledge that, "No sapiential chapter is so much work as the certification of this matter, because it is the great foundation of all human comprehension, and conflicts and doubts multiply intermingle, and authors and volumes must be turned over more abundantly than for any other article that is worth finding in any study of wisdom."[16] Bacon was very prone to exaggerate his own labours, but this appears to have been less the case here than elsewhere, for the careful collations of Josephus, Augustine and others seem to have been his own work and not drawn from *florilegia* or other intermediate sources. This scholarship then provided the epistemic backdrop for further endeavours, and also pointed to potentially fillable gaps in the knowledge of Latin Christendom.

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[14] *Opus maius*, ed. Bridges, III, 67-8.

[15] *Fr. Rogeri Bacon Opera Quaedam Hactenus Inedita, Vol. I, containing I.—Opus tertium; II.—Opus minus; III.—Compendium philosophiae*, London 1859, 24. In quoting from the *Opus tertium* I use the new edition with English translation which I am in the course of preparing.

[16] *Opus maius*, ed. Bridges, III, 53.

These seemed to call in particular for translations into Latin. Many had of course been made in the 150 years before Bacon's time of writing, but much remained to be done. In particular, Bacon held (exaggeratedly) that a huge amount of Aristotle's work remained untranslated, and also much of Avicenna, including all of his "oriental philosophy".[17] But perhaps more importantly most of the existing translations were corrupt and misleading, and Bacon set exceedingly high standards:

> While it is necessary that an interpreter should know excellently the science which he wishes to translate and the two languages from which and into which he translates, only Boethius the first interpreter knew fully the power of languages and only the Lord Robert called Great Head, lately Bishop of Lincoln, knew the sciences. Some other middling ones, like Gerard of Cremona, Michael Scot, Alfred the Englishman and Hermann the German, whom we saw at Paris, lacked much both in languages and sciences, as the same Hermann confessed of himself and the others. And their translation displays this.[18]

The remedy was obviously going to be exceedingly difficult, and in writing to the Pope Bacon emphasised the expenses that would be involved.[19] He himself projected a fourfold grammar of Greek, Hebrew, Arabic and Chaldean, and wrote at least a substantial amount of the Greek part, and a little of the Hebrew.[20] His knowledge of Arabic remains problematic.[21] Meantime Bacon could conveniently blame bad translations for opinions with which he disagreed but which appeared to come from respected authorities, especially Aristotle.

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[17] *Opus maius*, ed. Bridges, III, 85. On Bacon and Avicenna's Oriental Philosophy cf. A. Birkenmajer, *Avicennas Vorrede zum 'Liber Sufficientiae' und Roger Bacon*, in: Revue Néoscholastique de la Philosophie, 36 (1934), 308-20, reprinted in Birkenmajer, *Etudes d'Histoire des Sciences et de la Philosophie du Moyen Age* (= *Studia Copernicana*, I), Wroclaw 1970, 89-101.

[18] *Opus maius*, ed. Bridges, III, 82; cf. *Opus tertium*, ed. Brewer, 91.

[19] Cf. *Opus tertium*, ed. Brewer, 34.

[20] *The Greek Grammar of Roger Bacon and a Fragment of his Hebrew Grammar*, ed. Edmond Nolan & S. A. Hirsch, Cambridge 1902, 3.

[21] Cf. M. Bouyges, *Roger Bacon a-t-il lu des livres arabes?*, in: Archives d'Histoire Doctrinale et Littéraire du Moyen Age, 5 (1930), 311-5. On Bacon and languages in general see S. A. Hirsch, *Roger Bacon and Philology*, in: *Roger Bacon: Essays*, ed. A. G. Little (Oxford, 1914), 101-51.

New and better translations were an obvious way of gaining knowledge by latching more securely onto an earlier point in the chain of translations, but there was also a possibility of restoring knowledge independently of the pre-existing historical chain. And here we encounter the way of experience, and Bacon's famous doctrine of experimental science. It is important to take this on its own terms, for otherwise misunderstandings arise:

> Experience is twofold. One kind is by the external senses... And this experience is human and philosophical, as much as man can do according to the grace given to him, but this experience is not sufficient for man, because it does not fully make known about corporeal things because of their difficulty, and it does not reach anything concerning spiritual ones. Therefore man's intellect must be helped in another way, and so the holy patriarchs and prophets, who first gave sciences to the world, received internal illuminations and did not halt at sense. And similarly many of the faithful after Christ, for the grace of faith illuminates much, together with divine inspirations, not only in spiritual matters, but in corporeal and in the sciences of philosophy, according as Ptolemy says in the *Centiloquium* that the way of coming to the knowledge of things is twofold, one by the experience of philosophy, and the other by divine inspiration, which as he says is much the better.[22]

Thus, although, as Bacon himself makes clear, knowledge may be created or restored by means akin to modern experimental science, the type of revelatory experiences that were accorded to prophets was to be preferred.

Also the mention of Ptolemy suggests that such illuminations would not be confined to ancient Jews and to Christians, and elsewhere in the *Opus maius* it is made clear, albeit rather cagily, that this was indeed the case:

> Since the philosophers themselves were dedicated to truths and to all goodness of life, despising riches, delights and honours and aspiring to future felicity so far as human frailty could, and were made victors over human nature, as Jerome writes of Diogenes in the *Book against Jovinianus*, it is no wonder if God, who illuminated them in these lesser matters, accorded them some lights of great truths, and if not principally for their own sakes then for ours, so that by their persuasions the world would be disposed towards faith. And for this He arranged that many Sibyls were found, that is ten prophetesses, as all the saints agree, such as Augustine in Book XVIII of the *City of God*, and Isidore in Book VII of the *Etymologies*, and others similarly. And histories and philosophers and poets universally agree about the Sibyls, but it is certain that they recounted divine things, and what are held about Christ and future judgment and the like. Therefore it is much more probable that the wisest and best philosophers received such truths from God.[23]

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[22] *Opus maius*, ed. Bridges, II, 169-70.

[23] *Opus maius*, ed. Bridges, III, 73.

And in the *Opus tertium* when commenting on this passage Bacon was terser and more direct: "It pleased God to give wisdom to whom He willed, for all wisdom is from the Lord God, and He revealed it to the philosophers, to infidels as well as to the faithful."[24]

Experimental science included as part of what Bacon called its second prerogative, the search for the prolongation of life, and this tied in symbiotically with his epistemological scheme:

> Josephus in Book I of the *Antiquities* says that, since the sons of Adam through Seth were religious men and made by God himself, God gave them six hundred years to live on account of the glorious parts of philosophy in which they studied, so that what God revealed to them they could experience by length of life.[25]

Since that time things had got much worse, but clearly a greatly increased lifespan was eminently desirable for the good of science:

> Medical art has no remedy other than regimen of health, but a further extension of long life is possible. From the beginning of the world there was great prolongation of life, but now it is shortened beyond measure. Many reckoned the cause of this lengthening and shortening to be from the heavens, for they reckoned that the heaven's disposition was best at the beginning, and that with the world growing old all things waste away, reckoning that the stars were created in more appropriate places ... and in a better mutual ratio according to diversity of aspects and invisible projection of rays, and that they gradually receded from that state, and according to this receding they posit the shortening of life up to some fixed term, in which there is a halt, but this has many contradictions and difficulties, of which it is now to speak.[26]

Bacon was usually a strong proponent of astrological influences, but in this instance he opined that the main cause was a bad regimen of life, whose effects were transmitted through the generations.

A potent remedy had been available in very early times, knowledge of which was purveyed by the pseudo-Aristotelian *Secretum Secretorum:*

> There is a medicine that is called the Inestimable Glory and the Philosophers' Treasure, which fully rectifies the whole human body and which is said to have been discovered by Adam or by Enoch, and received by a vision, as [Aristotle] relates, although it was not fully certified which of them had first perceived it. But this and similar most secret of secrets were always hidden from the crowd of philosophers, and especially after men began to abuse wisdom, turning to evil what God had conceded for men's health and full utility.[27]

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[24] *Opus tertium*, ed. Brewer, 32.

[25] *Opus maius*, ed. Bridges, III, 54.

[26] *Opus maius*, ed. Bridges, II, 204.

[27] *Opus maius*, ed. Bridges, II, 208-9. Bridges has *gloria ineffabilis*, but elsewhere (III, 58) in his edition of the *Opus maius*, it is *gloria inestimabilis*, as also in the Latin version of the *Secretum secretorum* that Bacon annotated (*Opera hactenus inedita*, V, 98-9). On this medicine see R. Steele, *A Medieval Panacea*, in: Proceedings of the Royal Society of

Bacon himself toyed, theoretically if not practically, with this and other quasi-alchemical remedies, and this helped to give him a firm place in the later English medical tradition.[28] Also his name became attached to many alchemical spuria, which together with his genuine alchemical writings, contributed to his subsequent reputation.

2. *Magic and the Multiplication of Species*[29]

Alchemy may be regarded as quintessentially "Hermetic", but for the second part of this paper I wish to dwell instead on another way in which Bacon bordered upon magical traditions. We may start by quoting one of Bacon's more famous passages, which to his contemporaries and medieval and Renaissance successors would have been far more redolent of magic than it was for later ages:

> Instruments of navigation can be made without men for rowing, so that great ships, both river and sea going, may be borne along with just one man steering, and with greater speed than if they were full of men. Also chariots can be made to move without an animal with inestimable force, as we reckon the scythed chariots to have been which were used for fighting in ancient times. Also there can be made instruments of flying with a man sitting in the middle of the instrument and revolving a contrivance by means of which artificially composed wings beat the air, like a flying bird. Also an instrument, small in quantity for raising and lowering almost infinite weights. Nothing is more useful in adversity, for by an instrument of height three fingers and width the same, or even of smaller size, a man may snatch himself and his comrades from every danger of prison, by raising and descending. An instrument could also easily be made whereby one man would drag to himself a thousand men violently and against their will, and similarly for attracting other things. Instruments may also be made for walking in the sea or in rivers, right to the bottom, without bodily danger. For Alexander the Great used these for seeing the secrets of the sea according to the account of Ethicus the astronomer. These were made in ancient times, and have been made in our own times as is certain, unless it be the instrument for flying, which

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Medicine, 10 (1917), 93-106; C. C. J. Webb, *Roger Bacon on Alphonse of Poitiers*, in: *Essays in History, presented to Reginald Lane Poole*, ed. H. W. C. Davis, Oxford 1927, 290-300; F. M. Getz, *To Prolong Life and Promote Health: Baconian Alchemy and Pharmacy in the English Learned Tradition*, in: *Health, Disease and Healing in Medieval Culture*, ed. S. Campbell, New York 1991, 135-45; W. R. Newman, *The Alchemy of Roger Bacon and the 'Tres Epistolae' Attributed to Him*, forthcoming. See generally on the question of prolongation of life, G. J. Gruman, *A History of Ideas about the Prolongation of Life* (= *Transactions of the American Philosophical Society*, 61_2, Part 9), Philadelphia 1966.

[28] See the article by Getz cited above, and C. Webster, *Alchemical and Paracelsian Medicine*, in: *Health, Medicine and Mortality in the Sixteenth Century*, ed. C. Webster, Cambridge 1979, 301-34.

[29] The second part of this article substantially incorporates my *Roger Bacon: Magic and the Multiplication of Species*, which was scheduled to appear in a special volume of *Paideia* that did not actually come to publication.

> I have not seen, nor have I known a man who had seen it, but I know a wise man who has thought out how to bring about this artifice. And almost infinitely many such things may be made, such as bridges over rivers without columns or any support, and unheard of contrivances and devices.[30]

As recently as 1960 J.R. Partington saw in the passage "predictions" (he was careful to place the word in inverted commas) of the motor car, aeroplane, diving bell, submarine, and suspension bridge,[31] while other recent scholars, wary of the perils of anachronism, have tended simply to ignore Bacon's list. It is admittedly difficult to reconstruct exactly what he had in mind,[32] but the passage does bear ample witness to his faith in man's practical possibilities.

Bacon held that the above instruments depended on art alone. Another instrument depended upon deeper powers of nature, and it was particularly the province of experimental science to find it out. A mathematician could make a spherical astrolabe of the type described by Ptolemy:

> but for it to be moved naturally with a diurnal motion is not in the mathematician's power. A faithful and wonderful experimenter, however, is striving that one be made from suitable material and with so much artifice that it would naturally be turned about with the heavens'[33] diurnal motion. It would seem to be possible to do this because many things are borne about with the motion of celestials, such as comets, and the sea in its flux, and other things either totally or in their parts. This would be a greater miracle than all the aforesaid and of almost infinite utility. For then all astronomical instruments would be obsolete, both specialised and common, and it would bear no comparison to a single king's treasury.[34]

Bacon mentions the subject of magnetism in a nearby passage, and he is clearly thinking of Petrus Peregrinus, who held that a properly pivoted magnet would rotate following the heavens' motion. Peter said that if one did not succeed in accomplishing this, it would be through lack of skill rather than a defect of nature; if one did, one would no longer need a "timepiece".[35]

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[30] *De secretis operibus artis et nature*, in: *Opera Quaedam Hactenus Inedita*, ed. Brewer, 533. Cf. *Communia Mathematica*, ed. Steele, *Opera Hactenus Inedita*, XVI, 43-4; *Part of the Opus Tertium of Roger Bacon, including a Fragment now Printed for the First Time*, ed. A. G. Little, Aberdeen 1912, 18; MS Vatican, Reg. Lat. 1317, f. 104r. This manuscript contains portions of the *Opus minus* that are not yet available in print.

[31] J. R. Partington, *A History of Greek Fire and Gunpowder*, Cambridge 1960, 72.

[32] For some earlier attempts at this, see the article on Bacon in *Biographia Britannica*, I, London 1747, 341-64.

[33] Reading *coelorum* for Brewer's *coelum*.

[34] *De secretis operibus*, ed. Brewer, 537.

[35] "Per hoc autem instrumentum excusaberis ab omni horilogio." S. Radelet-de Grave & D. Speiser, *Le* De magnete *de Pierre de Maricourt: Traduction et Commentaire*, in:

The fact that Bacon's proposed astrolabe would employ celestial influence prompts us to turn aside for a moment. In the *City of God* Augustine referred to a famous passage in the Hermetic *Asclepius* concerning man-made gods. Asclepius spoke of them as statues, but Hermes emphasized that they were much more:

> Statues? My dear Asclepius, what an infidel you are! Statues endowed with souls, fully equipped with sensibility and spirits; statues which perform such great and wonderful works; statues which foreknow the future, and foretell it by means of the lot, by means of seers and dreams and many other methods; which send diseases upon men and also cure them, bestowing sadness or joy, according to deserts.[36]

In the *Summa contra Gentiles* (1259-64) Aquinas denied that such statues could be moved by celestial virtue:

> To be moved by oneself follows on having a soul, for it is a *proprium* of animate things that they move themselves. It is therefore impossible that it be brought about by virtue of the celestial bodies that something inanimate be moved by itself. But it is said to be brought about by magical arts that some statues are moved by themselves or give out a voice. It is therefore not possible that the effect of magical arts be brought about by celestial virtue... A natural effect produced by the heavens' virtue may be found in the absence of art's operation. For even if by some artifice something should perform the generation of frogs and suchlike, it would yet happen that frogs be generated without any artifice. If therefore statues of this kind that are made by necromantic art obtain the principle of life by the celestial bodies' virtue, the generation of such will be found without art of this kind. But this is not found. It is clear therefore that suchlike statues do not have the principle of life nor are moved by the celestial body's virtue.[37]

The analogy with Bacon's astrolabe is by no means precise, but the discussion does reveal Bacon as operating near the borderlands of magic. The legend of the brazen head pushed the point more dramatically, for in it Bacon and his collaborator Bungay sought the advice of a devil in order to make the head that they had constructed speak.[38]

Bacon was adamant that he was not advocating magic, but his repetitive vehemence shows that he was conscious that he could be

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Revue d'Histoire des Sciences, 28 (1975), 193-234 at 220; E. Grant, *A Source Book in Medieval Science*, Cambridge, MA 1974, 373.

[36] *De civitate Dei*, VIII.23; translation from *Concerning the City of God against the Pagans*, tr. H. Bettenson, Harmondsworth 1972, 331. Cf. *Corpus Hermeticum*, ed. A. D. Nock & A.-J. Festugière, Paris 1945-54, II, 326. On Augustine and Hermes see Yates, *Giordano Bruno*, 9-12.

[37] *Summa contra Gentiles*, lib. 3, cap. 104, in Thomas Aquinas, *Opera Omnia iussa impensaque Leonis XIII P.M. edita*, Rome 1882- , XIV, 325-6.

[38] *Early English Prose Romances*, ed. W. J. Thoms, 2nd edn. London 1858, I, 205-11.

suspected of it. He held that a principal fault of magicians was their real or attempted meddling with demons for the production of certain effects.[39] They deluded themselves as to the extent to which demons were amenable to human control, but Bacon believed that many magicians' effects could be, and often were, produced by the power of art imitating nature, without the employment of anything extraneous. And indeed the ultimate source of many magical practices was in works of true wisdom:

> Solomon ordained many things of this kind, which were performed outwith the customary course of nature, as Josephus says in Book VIII.[40] And because he was wiser than all who came before and after, as Holy Scripture and Josephus teach, he could not neglect these works, and so left many writings in enigmas, which were later turned to bad use by magicians, and were badly interpreted, and many enormities were mixed in by deceivers.[41]

Bacon himself was intent on providing a rationale for effects that could all too easily be dubbed magical, and from his theoretical structure to derive practices that could be used for the greater good of Christendom. And for this end he was particularly prone to make use of the analogy of optics.

Bacon thought that optics itself could be put to many useful purposes.[42] He had been particularly fascinated by the construction of a burning mirror by Petrus Peregrinus, and later had several made for himself. Such mirrors could be a wonderful aid against the Saracens, as also could "broken mirrors", used for producing the illusion that an army was much bigger than it really was. Also perspect glasses could be arranged to allow us to see small things at an incredible distance, "for thus it is reckoned did Julius Caesar on the seashore in France by huge mirrors observe the disposition and arrangement of the castles and cities of Greater Britain."[43] These somewhat extravagant claims gained a certain plausibility from the conjuring tricks of contemporary jugglers, but Bacon also saw the whole science of optics as embedded in the wider doctrine of the multiplication of species.

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[39] On Bacon's view of magic see L. Thorndike, *A History of Magic and Experimental Science*, New York 1923-58, II, 659-77, and A. G. Molland, *Roger Bacon as Magician*, in: Traditio, 30 (1974), 445-60, at 458-60.

[40] *Antiquities* VIII.2.

[41] *Opus maius*, ed. Bridges, I, 392. This passage should more properly be assigned to the *Opus minus*; cf. *Roger Bacon: Essays*, ed. A. G. Little, Oxford 1914, 389.

[42] On the subject matter of this paragraph see Molland, *Roger Bacon as Magician*, 452-8.

[43] *De secretis operibus*, ed. Brewer, 534; cf. *Opus maius*, ed. Bridges, II, 165.

In this doctrine substances and qualities sent out likenesses of themselves in all directions (unless impeded), by means of which they acted on objects that were separated from them by a medium. From the light of the Sun there proceeded species of light in the medium, which could produce light in the Moon and the stars.[44] But, despite what some had said, light was not the substantial form of the Sun, and, moreover, the species of an accident could not exist without the species of a substance. Therefore the medium also transmitted species of the Sun itself, although these could not act in the same way as the species of light, for otherwise the Moon and the stars would be converted into the Sun. Species had the same specific nature as the original, but less complete being (*esse*), and sometimes much less:

> Some things can make strong species, like colour and light and heat, and other such... But as much as things are nobler, like celestial bodies and man and suchlike, by so much do they make a more incomplete species... And so the species of colour and light and heat can more be called light and heat and colour than the species of the Sun or a man be called man or Sun.[45]

A natural agent always gave out species in the same way, for it was only agents with free will that could on their own account act difformly.[46]

Bacon was the first Latin writer to assimilate with any thoroughness Alhazen's theory of vision, in which sight was effected by forms of light and colour entering the eye.[47] Although Bacon was much less mathematically astute than Alhazen, he gave more attention than had the Arabic writer to an ontological determination of what was going on in the medium. In producing species the agent does not give something out, for this would result in corruption of the original substance, whereas "the most active things, such as spiritual substances and celestial bodies, are not corruptible."[48] Instead (and this ensures that we do not have two bodies in the same place) the transmission proceeds by "a natural changing and drawing out of the potentiality of the matter of the patient."[49] The result is that the medium has superimposed on it the nature of the agent:

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[44] *Roger Bacon's Philosophy of Nature: A Critical Edition, with English Translation, Introduction, and Notes, of De multiplicatione specierum and De speculis comburentibus*, ed. D. C. Lindberg, Oxford 1983, 12-4.

[45] *De mult. spec.*, ed. Lindberg, 10-2.

[46] *De mult. spec.*, ed. Lindberg, 18.

[47] A. C. Crombie, *The Mechanistic Hypothesis and the Scientific Study of Vision*, in: *Historical Aspects of Microscopy*, ed. S. Bradbury & G. L'E. Turner, Cambridge 1967, 3-112, at 27; D. C. Lindberg, *Theories of Vision from al-Kindi to Kepler*, Chicago 1976, 109.

[48] *De mult. spec.*, ed. Lindberg, 44.

> The individual part (*individuum*) of air is assimilated to fire in the nature of fieriness by the species of the fire present in it. Therefore it is called fired air. For it is not air alone, nor fire alone, nor principally fire, but principally fired air alone. And so what is there of fire is the incomplete individual part of fire existing in something more complete.[50]

The transmission is not strictly continuous but takes place in a stepwise fashion, with the species in one small part of the medium drawing out its likeness in the next. But even here there are difficulties concerning action at a distance, for there only appears to be superficial contact between the two parts, whereas the agent must act on the depths of the patient. Bacon's answer, which is not altogether satisfactory, is that although the agent is not in the depths of the patient it does touch it sufficiently.[51] We are reminded of how at a much later date Michael Faraday was confronted with similar difficulties in his account of the propagation of action.[52]

Normally species were transmitted in straight lines, but if there was a change of density and the species were not approaching the interface perpendicularly, refraction occurred. On meeting a particularly dense body there was reflection. In discussing these matters Bacon was drawing principally on the optical tradition, and his examples usually concerned light. Nevertheless it is clear that he meant his account to apply to species in general, although he does not dwell on what particular differences there may be in the modes of propagation of species of different kinds. Also taken from the optical tradition was Bacon's frequent talk of pyramids (including what in modern terms are called cones). These were used to illustrate the convergence of species from the source or sources of radiation to the particular point of interest, which formed the vertex of the pyramid. In the case of vision this point was the eye. In animate bodies the species could also follow a tortuous path along the nerves. This applied not only to vision but, for instance, to the species of taste, which started along the nerve of the tongue and eventually reached a place near the heart.[53]

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[49] *Ibid.*

[50] *De mult. spec.*, ed. Lindberg, 16.

[51] *De mult. spec.*, ed. Lindberg, 52: "Dico quod agens tangit profundum prime partis quantum sufficit."

[52] See, for example, M. B. Hesse, *Forces and Fields*, London 1961, 199-200.

[53] *De mult. spec.*, ed. Lindberg, 102.

Unlike accidents, substances were not directly perceived by the five external senses, nor by the common sense. Nevertheless the species of a substance could impinge on the soul:

> It can well be had in a way by cogitation and estimation, by which a sheep senses the species of the wolf's complexion infecting and harming the organ of the estimative [virtue], and so it flees the wolf at first glance, even if it has never seen one before. And this is the species of a substance hurtful and hostile to the sheep. On the other hand, the species of the friendly and agreeable substance of another sheep comforts the estimative [virtue]'s instrument, and so one sheep does not flee another. Therefore the sensitive soul can well perceive substance by its species.[54]

Bacon was drawing the example of the sheep and the wolf from Avicenna's account of estimation,[55] but the expression in terms of the estimative virtue's ability to perceive the species of substances appears to be his own.

Avicenna's place in Bacon's genealogy of knowledge guaranteed his role as a special hero of science, and Averroes and Alhazen, as we have seen, both commanded his great respect. Among other Arabic writers, Bacon occasionally alludes to Alkindi, but significantly in the works for the Pope he does not refer to that writer's *De radiis stellaris*, although it would be hard to deny a strong influence from this short work, whose Latin version may be found in a fine edition by M.-T. d'Alverny and F. Hudry.[56] The connection was not lost on later writers, such as Giovanni Pico della Mirandola, who grouped Bacon and Alkindi together with William of Auvergne as writers who had understood the nature of good non-demonic magic.

The reason for Bacon's reticence may be gathered from a (probably) later writing of his going under the title *De laudibus mathematice*. Here Alkindi's work is briefly described but without mention of the author's name:

> False mathematics is the magical art, which usurps to itself the consideration of celestials with characters, charms, conjurations, and superstitious sacrifices, a consideration deformed by various frauds. And it posits that all things happen of necessity through the constellations' virtues, nothing either way, nothing from chance or fortune nothing from counsel... And these things are expressly

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[54] *De mult. spec.*, ed. Lindberg, 24.

[55] *Opus maius*, ed. Bridges, II, 7-8; *Communia Naturalia*, ed. R. Steele, *Opera Hactenus Inedita Rogeri Baconi*, II-IV, Oxford n.d.-1913, II, 17; *Avicenna Latinus. Liber de Anima, seu Sextus de Naturalibus* IV-V, ed. S. van Riet, Louvain & Leiden 1968, 38-9.

[56] M.-T. d'Alverny & F. Hudry, *Al-Kindi*: De radiis, in: Archives d'Histoire Doctrinale et Littéraire du Moyen Age, 41 (1974), 139-260.

> asserted in a magical book, whose title is infamous, namely *Theory of the Magical Art*, which several have changed into *Book of Rays*, because the book's author puts forward many excellent things about the multiplication of rays, which are philosophical and true, so that he may the better draw the readers' minds to the poison of falsity that is his principal intent. Wherefore he posits them all to happen through the heaven by necessity, and he presumes by this necessity to judge infallibly of all future things, but this mathematics is condemned not only by saints but by philosophers.[57]

This puts the book into a favourite category of Bacon's, that of works which are in general to be eschewed, but which still need to be studied by the cognoscenti on account of the portions of genuine wisdom that they contain. Bacon was very careful to avoid any imputation that he advocated magic, and ironically Alkindi was a great aid in this by postulating a naturalistic explanation of phenomena that might otherwise be regarded as magical.

Like Bacon, Alkindi used optics as providing a paradigm case of the communication of action. But while Bacon spoke of species and virtues, Alkindi usually contended himself with references to rays, and gave little attention to their ontological determination. All stars and all things that have actual existence in the elementary world emit rays, and these have multifarious effects according to the different natures of their sources and the different positionings of the sources with respect to the recipients. At one level at least, all action in the elementary world, even contact action, is to be explained by the infusion of rays. Action at a distance is sometimes manifest to the senses, as when a magnet attracts iron or a mirror presents images to the eyes, but at other times it is more hidden. Both Bacon and Alkindi attach particular importance to the rays that proceed from the heavens, or as

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[57] "Falsa mathematica est ars magica que sibi usurpat considerationem celestium caracteribus carminibus coniurationibus et sacrificiis superstitiosis et fraudibus variis deformatam. Et ponit per virtutem constellationum omnia de necessitate contingere nihil ad utrumlibet nihil a casu nec fortuna nihil a consilio... Et hec expresse asserantur in libro magico cuius titulus infamis est, scilicet Theorica Artis Magice, quem plures mutaverunt in Librum de Radiis, quia auctor illius libri multa preclara premittit de radiorum multiplicatione que philosophica sunt et vera ut magis alliciat animos legentium ad venenum falsitatis quod principaliter intendit, unde ista omnia ponit per celum de necessitate contingere et presumit per hanc necessitatem infallibiliter de omnibus iudicare futuris sed ista mathematica dampnata est non solum a sanctis sed a philosophis." MSS Oxford, Bodleian, Digby 218, f. 98v; London, British Library, Royal 7 F.vii, f. 72v. Cf. *Roger Bacon: Essays*, ed Little, 393-4. In MS Oxford, Bodleian, Selden Supra 79, p. 26a, Brian Twyne noted with reference to this passage that, "Verisimile est hic Baconum tractatum istum Alkindi de radiis intellexisse, qui aperte omnia necessitate ascribit."

Alkindi usually says, the celestial harmony. But here important differences begin to arise, for Alkindi was a more rigorous thinker than it would have been wise for Bacon to be. And even if Alkindi can sometimes remind us of Leibniz, Giles of Rome found little difficulty in listing eighteen errors from this short work alone.[58]

Important among these was the fact that Alkindi was a rigid astrological determinist. Whatever may seem to be the case, things below were caused down to the minutest detail by the action of the heavens:

> Thus it is that one who had the total condition of the celestial harmony known to him would know things past together with those present and future. Conversely the condition of one individual of this world, fully known, would present as if by a mirror the whole condition of the celestial harmony, since each thing of this world is an image of the universal harmony.[59]

The pre-eminence of the heavens made Alkindi in the last analysis deny the action of one body in the elementary world on another, and he distinguished what is true according to physics from what is true according to metaphysics:

> According to such a consideration on the part of the crowd we say that one elementary thing acts on another by its rays, while according to ascertained truth it does not act, but the celestial harmony alone works all things. Therefore in elementary things sustaining the passion introduced by such action there will only be a concomitance, which we name action and passion. When we consider the mutual conditions and colligations of elementary things without respect to the celestial cause, the consideration will be physical, whether the things be conjoined or separated in place. But when we investigate elementary events by celestial causes we adopt a metaphysical consideration.[60]

The God of Alkindi's treatment is highly transcendental, and can only be described apophatically. Names such as cause of causes, god of gods, lord of lords, first principle, creator are inappropriate; better, if still not satisfactory, are negative expressions such as infinite, uncreated, immortal, impassible.[61] It is not to be supposed that such a completely immobile being should be moved by men's prayers, although these can have great effect by their action on elementary matter, or rather, to speak metaphysically, by means of the celestial disposition.[62]

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[58] Giles of Rome, *Errores Philosophorum*, ed. J. Koch, Milwaukee 1944, 46-59.
[59] *De radiis*, ed. d'Alverny & Hudry, 223.
[60] *De radiis*, 228-9.
[61] *De radiis*, 244-5.
[62] *De radiis*, 246-7.

It is doubtful that such views would have been popular in Islam; in thirteenth-century Christian Europe they were impossible, and, as we have seen, necessitarianism was one of the main faults that Bacon found in Alkindi's work. Nevertheless, he acknowledges that great power proceeds from the heavens, although this does not coerce the yet nobler rational soul:

> A person may be induced to good or bad, both public and private, by the heavens' virtues, but without compulsion, just as, for example, we see that men change their wills because of masters, friends and fellows, and the presence of new things, and in many other ways, but without compulsion.[63]

Moreover, if astrology foretells certain events, the wise man, even if he cannot prevent them, may take remedial action. For example (and here Bacon draws on the pseudo-Aristotelian *Secretum secretorum*) we may guard against the advent of a particularly cold spell by stocking up with medicaments, warm clothes, etc...[64] And Isaac Israeli had said that, when the best mathematicians knew the days on which men going down to sea or into battle were due to die, they could provide sufficient protection for them.[65]

In his discussions of astrology Bacon did not labour the doctrine of the multiplication of species, but it is clear that it provided the theoretical underpinning for the subject. It was particularly useful for explaining the immense diversity that resulted from celestial influence. Not only is the celestial configuration continually changing, but each point of the Earth's surface is the centre of a different horizon, and so receives a different pyramid of rays from the sky.[66] This explained the simultaneous production of different herbs in nearby places and even the differences of twins in the same womb. In this Bacon was coming perilously near to denying the predictive power of astrology, for if such minute differences in celestial influence are so important in effect, then surely it will be possible neither for the astrologer to tabulate them, nor to make measurements of the required accuracy. In the next century similar considerations led Nicole Oresme to deny the usefulness of astrology as a tool for knowing the future in any detail.[67] But Bacon did not take up this point, and if pressed would probably have said that exact knowledge of the future was impossible to human kind, but that this did not prevent predictions of a middling sort of detail being possible.

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[63] *Opus minus* in: *Opus maius*, ed. Bridges, I, 393. (Cf. n. 41 above.)

[64] *Opus minus* in: *Opus maius*, ed. Bridges, I, 390. Cf. *Secretum secretorum, cum Glossis et Notulis*, ed. Steele, *Opera hactenus inedita Rogeri Baconi*, V, 61.

[65] *Opus minus* in: *Opus maius*, ed. Bridges, I, 391.

[66] *Opus maius*, ed. Bridges, I, 138; *Opus minus* in *Opus maius*, ed. Bridges, I, 380.

[67] See, for example, Molland, *Medieval Ideas of Scientific Progress* (n. 13 above), 576.

For both Alkindi and Bacon human beings, as well as the heavens, were particularly important sources of rays. In this Alkindi appealed to a macrocosm-microcosm conception and held that man was acting as a similitude of the heavens, whereas Bacon simply appealed to the rational soul being nobler than the heavens. For both writers different psychological states were particularly important, and although they do not use the analogy in precisely the same way, both appeal in this connection to the example of adding scammony to a medicine.[68] Again both give particular attention to the efficacy of words in producing the desired results, and both insist on this being a natural process that does not rely on the action of demons or spirits.[69] I shall not here attempt any detailed comparison between their views, but concentrate on Bacon. He is conscious that he may seem very near to dabbling in magic, and makes particular appeal to the doctrine of multiplication of species as an alternative view:

> Because this multiplication of species is unknown to the crowd of students, nor to anyone among the Latins except three or four, and that [only] in optics (*in perspectivis*), namely the multiplication of the species of light and colour for vision, on that account we do not perceive [as such] the marvellous actions of nature that all day are made in us and in things before our eyes, but we estimate them to be brought about either by a special divine operation, or by angels, or by demons, or by chance and fortune. But it is not so, except so far as every operation of a creature is in some way from God. But this does not prevent the operations being made according to natural reasons, because nature is an instrument of divine operation.[70]

Magicians are in fact impotent, although the devil may sometimes mischievously make it appear otherwise.[71]

A successful operation with words needs strong psychological backing. There should be profound thought, great desire, right intention, and strong confidence. For a good act holiness of life is important, and for a bad act the opposite. The excited soul has a strong influence on the body, and modifies the species that it produces, so that we have a mingling of species: from the voice modifying the air, from the rational soul, and from the body.[72] Moreover, the utterances should be made at the right astrological time so that to these species are added the appropriate celestial ones. It is thus that the efficacy of charms and incantations is to be explained. The written word may have similar power, for if characters are fashioned at the due time, they receive celestial virtue and are able to retransmit it. All of this naturalised magic has great power. "Bodies are healed, venomous animals are put to flight, and brutes of all kinds are called to hand, both serpents from caves, and fishes from the depths of the water."[73] It is also from this source that arises the power of fascination and casting the evil eye, and Bacon goes so far as to suggest a holier application. "A sign of [the great efficacy of words] is that almost all the miracles that have been performed by the saints from the beginning were performed by the power of words."[74]

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[68] *De radiis*, ed. d'Alverny & Hudry, 232; *Opus minus* in *Opus maius*, ed. Bridges, I, 398.

[69] *De radiis*, ed. d'Alverny & Hudry, 247; for Bacon see below.

[70] *Opus tertium*, ed. Brewer, 99-100.

[71] *Opus tertium*, ed. Brewer, 96, 98.

In writing of these matters to the Pope, Bacon introduced a note of particular urgency, for Antichrist, whose day was fast approaching, would use this power of wisdom to evil ends. It was imperative that Christians be forearmed with similar skills. Moreover, the Saracens and Tartars were already using such weapons, and Bacon drew an example from his own experience. In 1251 there had occurred in France the uprising of the Pastoureaux, an anti-intellectual rabble with a charismatic leader, said to be from Hungary, who announced an intention of going to the East to rescue Louis IX from prison.[75] For Bacon he was clearly a Tartar or Saracen agent, and his power came from the type of knowledge that Bacon advocated:

> With my own eyes I saw him openly carry something in his hand as if it were a sacred object, and as if he were a man bearing relics, and he went with bare feet, and around him there was a multitude of armed men, but dispersed in the fields in such a way that he could be seen by all the followers together with that which he carried in his hand with great display.[76]

Matthew Paris reports that the leader continually clutched in his hand what he claimed to be a missive from the Virgin Mary.[77] Bacon clearly did not believe this, but the object was certainly something of great power, and was doubtless sending out forceful species.

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[72] See especially *Opus tertium*, ed. Brewer, 96-8.

[73] *Opus minus* in *Opus maius*, ed. Bridges, I, 395.

[74] *Opus minus* in *Opus maius*, ed. Bridges, I, 399.

[75] S. Runciman, *A History of the Crusades*, Cambridge 1951-54; repr. Harmondsworth 1965, III, 279; A. Murray, *Reason and Society in the Middle Ages*, Oxford 1978, 244-5; J. Delalande, *Les Extraordinaires Croisades d'Enfants et de Pastoureaux au Moyen Age*, Paris 1961, 41-52.

[76] *Opus minus* in *Opus maius*, ed. Bridges, I, 401-2.

[77] Matthew Paris, *Chronica Majora*, ed. H. R. Luard (London 1872-83), V, 247.

Bacon was a firm advocate of the power of mind over matter, and as an example of what even the lower faculties of the soul could accomplish he liked to tell a story of Avicenna's about a hen, who from pride out of winning a fight with a cock, immediately grew a spur on her leg.[78] For Bacon both spiritual and corporeal action were to be subsumed under a single science of multiplication of species, formed from the analogy of optics. Centuries later there did arise a generalised optics, the science of electromagnetic radiation, which gave rise to marvels that even Bacon did not envisage, although not including the mental and the spiritual. To claim for Bacon any significant influence on this development would be fanciful, but he did exert an appreciable influence on another optical generaliser, namely John Dee, who wrote a work (now lost) called, "Mirror of Unity, or Apologia for Friar Roger Bacon the Englishman, in which it is shown that he did nothing by the aid of demons, but was a most great philosopher, and performed naturally and in ways allowable to a Christian man the great things which the unlearned crowd is wont to ascribe to the actions of demons."[79]

Which brings us back to Renaissance Hermeticism. I think that it is now clear that, when we construct any genealogy of "Science and the Hermetic Tradition", a significant medieval place must be accorded to Roger Bacon. But the question of how many other medieval links there were in the chain, and of what nature, must wait upon further research.[80] And moreover, there still remains the vexed problem of the effect of all this on the actual development of science.

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[78] *Opus minus* in *Opus maius*, ed. Bridges, I, 402; *Opus tertium*, ed. Brewer, 96; Avicenna, *Opera*, Venice 1508, *De animalibus*, f. 40v.

[79] *John Dee on Astronomy: Propaedeumata Aphoristica (1558 and 1568), Latin and English*, ed. & tr. W. Shumaker, int. J. L. Heilbron, Berkeley 1978, 116. Cf. my essay review of this volume, *Mathematical and Angelic Astrology*, in: British Journal for the History of Science, 13 (1980), 255-8. On Dee and his relation to Bacon, see especially Clulee, *John Dee's Natural Philosophy* (n. 2 above).

[80] I am currently preparing a paper on Thomas Bradwardine's stance towards *prisca auctoritas*.

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The Corpuscular Theory of J.B. Van Helmont and its Medieval Sources

WILLIAM R. NEWMAN

1. Van Helmont and Lasswitz

One common view of the scientific revolution is as a period in which the "mechanical philosophy" came ever more to dominate the natural sciences. Although the term "mechanical philosophy" is fraught with difficulty, a convenient way of defining it may be found in Robert Boyle, who labelled it as the attempt to reduce natural explanations to those "two grand and most catholick principles of bodies, matter and motion".[1] In this definition Boyle was of course following the lead of Descartes, and if it does less than perfect justice to his own system, at least it allowed Boyle and many others an ideal for which to strive.[2]

It may come as a surprise then to learn that one branch of the scientific revolution "reformed" a perfectly straightforward corpuscular theory of matter, devoid of the despised substantial forms and occult qualities of the scholastics, by investing it with vitalism. I have in mind the "the philosopher by fire", or chemical philosopher, Joan Baptista Van Helmont, and his hitherto unnoticed reworking of medieval corpuscular notions. The average early modernist may be inclined at this point to turn aside, for Van Helmont is often regarded as an obscure follower of Paracelsus von Hohenheim who contributed little to the mainstream of the scientific revolution. Such a view is radically mistaken, however, for Van Helmont was one of the earliest chemists to debunk the Paracelsian theory that three principles, mercury, sulfur, and salt, pre-existed in material substances, and his attack formed the basis of Robert Boyle's *Sceptical Chymist.*[3] Van Helmont was also an avid attacker of astrology, and an inveterate opponent of the metaphorical speech employed by Paracelsus.[4] He was a critic of the writer on talismanic magic Jacques Gaffarel, and an ally of Pierre Gassendi against Robert Fludd.[5] Van Helmont corresponded with Gassendi, and a number of letters from him to Mersenne have survived.[6] These concern such diverse topics as the nature of the soul and the cause of springness in steel.[7]

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[1] Robert Boyle, *Works*, 1772, III, 16. See also IV, 68-69, and IV, 77-78. For some of the problems implicit in the term "mechanical", cf. E. J. Dijksterhuis, *The Mechanization of the World Picture*, Oxford 1961, 495-501.

[2] I.B. Cohen, *Revolution in Science*, Cambridge MA 1985, 153-7.

The recent study of Van Helmont by Walter Pagel, while giving a masterful portrayal of the Belgian's biological views, seems to be quite unaware of the fact that Van Helmont entertained corpuscular views of matter.[8] The fact has not entirely escaped scholarly notice, however, for the brilliant historian of atomism, Kurd Lasswitz, already brought attention to Van Helmont's corpuscularism over a century ago.[9] Lasswitz wrote a penetrating analysis of several treatises appearing in Van Helmont's *Ortus medicinae*, in which he came to grips with the Helmontian theory of evaporation. As Lasswitz pointed out, Van Helmont asserts in his *Gas aquae* that water cannot be turned into air, but it can be attenuated to the point of becoming "vapor" or if still more rare, "gas". These products are merely "extenuated water", brought into that state by ''local division'' and ''extraversion of parts''.[10]

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[3] Allen G. Debus, *Fire Analysis and the Elements in the Sixteenth and the Seventeenth Centuries*, Annals of Science, 23 (1967), 127-47. J.R. Partington, *A History of Chemistry*, London 1961, Vol. II, 222 and 500-1.

[4] Brian Vickers, *Occult and Scientific Mentalities in the Renaissance*, Cambridge 1984, 1-55 and 95-163, *passim.*

[5] *Correspondance du P. Marin Mersenne*, Paris 1945, Vol. II, 532, where Van Helmont criticizes Gaffarel as one who "faict rapsodie du superstitieux..." and Vol. II, 584, where he rejects Fludd.

[6] *Correspondance du P. Marin Mersenne*, Paris 1945, Vol. II, and Paris 1969, Vol. III.

[7] It is clear that Mersenne was actively soliciting this information from Van Helmont, for the latter's letters are often written in the form of itemized responses to questions. Cf. *Epistolae* 189, 191, and 194 for examples.

[8] Walter Pagel, *Joan Baptista van Helmont*, Cambridge 1982.

[9] Kurd Lasswitz, *Geschichte der Atomistik*, Hamburg and Leipzig 1890, I, 343-51. Cornelis de Waard, the editor of Mersenne's letters, was also aware of this. Cf. *Correspondance du P. Marin Mersenne*, Paris 1969, Vol. III, 49: "Il apparaît que les vues de Van Helmont ne s'éloignaient guère d'une théorie corpusculaire de la matière, dont il identifie les pores avec le *magnale*". Two other authors who have brought attention to Van Helmont's corpuscular tendencies, however briefly, are the following: Partington, *A History of Chemistry*, London 1961, II, 224, and Reijer Hooykaas, *The Concept of Element (trans. of Het Begrip Element)*, H.H. Kubbinga, trans., (privately printed, 1983), 167-72.

This ''extraversion'' of water particles is critical to the understanding of Van Helmont. Following Paracelsus, Van Helmont asserts that water is itself composed of the three principles, mercury, sulfur, and salt.[11] These three cannot be separated in water, but they can exchange places. When water is heated, the salt, which cannot tolerate heat, is forced upward, and since the mercury and sulfur cannot be divided from it, they follow the salt. If the vapor then passes into yet higher regions, mercury can ''no longer keep its salt in solution'',[12] so it becomes a ''gas''. In order to protect the mercury and salt, the warmer sulfur forms a skin over them, but in doing so, it becomes attenuated. In the process, the mercury and salt also become attenuated, since they are attached to the sulfur. This attenuation occurs by a division of the water into ''the smallest possible particles'', that is, ''gas''.[13] Lasswitz makes the following observations about this process:

> Vapor and gas are thus distinguished by the different ordering of the principles in their smallest particles: in the case of vapor, as in that of water itself, the sulfur is enveloped by the salt dissolved in the mercury, and this is again changed back into water merely by cooling off. But in the case of the gas, the mercury and salt are frozen and covered by the sulfur. The gas of itself does not return to water, nor descend again without an external agent; this is provided by the Blas, that is, an expulsive movement from the stars, which forces the gas back down....[14]

The upshot of this is that water is vaporized by mere attenuation or attrition of its particles into ''atoms''. But gas is produced when these are further divided and literally turned inside out by an "extraversion". These particles or "atoms"[15] are forced to descend by the exhalations of the stars, whereupon they encounter the tepid air of the lower atmospheric regions. There the sulfurous covering of the corpuscles breaks "just like a bursting skin, or like glass which is broken when transferred from a tepid environment to a cold one".[16]

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[10] Van Helmont, *Gas aquae*, in *Ortus medicinae*, 46, no. 10: ''Non intercedit enim essentiae mutatio, ubi sola est localis divisio, & partium extraversio''. All quotations from Van Helmont's work will be drawn from the 1667 Lyons edition of his *Ortus medicinae*, unless otherwise noted.

[11] Here Van Helmont acknowledges that he is speaking analogically, despite his general inclination to avoid metaphor. Interestingly, he says that he is using the same method as astronomers do when they describe their eccentrics (46, no. 8-9).

[12] Lasswitz, 345.

[13] Lasswitz, 345.

[14] Lasswitz, 345-6: ''Dunst und Gas unterscheiden sich also durch verschiedene Anordnung der Grundsubstanzen in ihren kleinsten Teilen; beim Vapor ist wie beim Wasser der Sulphur von dem im Mercurius geloesten Sal eingehuellt, und jener verwandelt sich daher bei blosser Abkuehlung wieder in Wasser. Beim Gase dagegen ist Mercurius und Sal erstarrt und vom Sulphur eingehuellt. Das Gas wird daher nicht von selbst wieder zu Wasser und steigt nicht von selbst wieder herab, sondern es bedarf dazu eines aeusseren Antriebes; diesen gibt das *Blas*, das ist eine von den Sternen herwehende Bewegung, welche das Gas wieder herabdrueckt....''

This interesting theory surely owes as much to Van Helmont's baroque imagination as it does to empirical observation, and yet it shows several signs of advance over Van Helmont's contemporaries. The notion of gas as something distinct from vapor, and the accompanying awareness that there can be different gases, is Helmontian. More than this, as Lasswitz realized, Van Helmont's theory had "particular importance for the development of corpuscular theory".[17] Van Helmont considered not only the "quantitative relation" of the three principles to one another, but also their "spatial disposition":

> The passage from the vapor to the gaseous state consists in an extraversion of the sulfur. This, however, implicitly supposes the existence of distinct corpuscles, whose formation is also referred to under the rubric of further division [of particles]. The principles are here openly thought of already as the smallest particles of the body.... Water and Gas are the same, but in a different ordering of the components within the individual particles....[18]

Lasswitz thus accepted that Van Helmont's water corpuscles were made up of real sub-particles in the form of mercury, sulfur, and salt. Therefore Van Helmont's water particle is a complex corpuscle, which as Lasswitz states, "verges on the molecule theory" of modern chemistry.[19] Although one might argue with the finer points of Lasswitz's interpretation, he was surely right in arguing that within the water corpuscle, Van Helmont allocated spatially distinct layers to the principles. The theory of *extraversio* and *intraversio* implies—as

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[15] Van Helmont, *Gas aquae*, in *Ortus medicinae*, 47, 20-21.

[16] Van Helmont, *Gas aquae*, in *Ortus medicinae*, 47, 20-21: "Tepor nempe suavis, in aere tranquillo, atomos Gas decidere facit, suo sulfure contectos, qui velut pelle disrupta, aut vitri instar, a tepido, in frigus repente delati frangitur...."

[17] Lasswitz, 350.

[18] Lasswitz, 350: "Die Uebergang vom Dampf zum Gaszustande besteht in einem Nachaussenkehrung des Sulphurs. Das aber setzt doch stillschweigend das Vorhandensein von getrennten Korpuskeln voraus, deren Entstehung auch unter dem Namen der weiteren Teilung erwaehnt wird. Die Grundsubstanzen sind hier offenbar bereits als kleinste Teile der Koerper gedacht.... Wasser und Gas sind dasselbe, nur in anderer Anordnung der Bestandteile in den einzelnen Partikeln...."

[19] Lasswitz, 350.

Lasswitz said—that there is no real difference between water and *Gas* other than the ordering of their internal principles.

2. *Van Helmont and Alchemy*

2.1. *Jābir ibn Ḥayyān*

Writing in the late nineteenth century, Lasswitz was in no position to address the matter of Van Helmont's sources. It is possible now to see the confluence of two alchemical traditions in Van Helmont's "shell theory", however, as we shall proceed to show. One of these derives from the sixteenth-century iatrochemist Paracelsus von Hohenheim, the other from the medieval school associated with the name of "Jābir" or in its Latin form, "Geber". According to the traditional bio-bibliography of the Muslims, Jābir ibn Ḥayyān was a Persian alchemist who lived at some time in the eighth century, and wrote a wealth of books on virtually every aspect of natural philosophy. Fortunately, the brilliant work of Paul Kraus in the 1940's allows us to say with some certainty that the vast majority of the surviving works ascribed to Jābir are in fact forgeries, many penned a good century after the master's death.[20] Kraus argued with great perspicacity that the name of Jābir ibn Ḥayyān became a sort of "trademark" under which a school or schools of Ismāᶜīlī authors promoted their scientific and eschatological views.

For our purposes the importance of the Jābir corpus lies in the "theory of the balance", a doctrine that Jābir did not invent, but which he or his epigones promoted at great length. The "balance" was based on an assumption that every material substance contains its opposite, but in a "hidden" fashion.[21] Thus every substance has a *bāṭn* and *ẓāhir*, an "occult" and a "manifest" (*occultum* and *manifestum* in Latin), or an "interior" and "exterior". Jābir employs this terminology of "occult" and "manifest" interchangeably with "center" and "circumference". Hence lead, which is cold and dry "externally", contains the opposite qualities, hot and wet, "internally". Gold, on the other hand, is hot and wet "externally", and cold and dry "internally". Now since Jābir argues that "the transmutation of metals is reducible to a simple interchange of the elementary qualities'',[22] it is obvious that such knowledge could serve to one's material advantage. By ''inverting'' the interior qualities of lead, one could arrive at gold.

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[20] Paul Kraus, *Jābir ibn Ḥayyān, Contribution à l'histoire des idées scientifiques dans l'Islam*, I, Cairo 1943, XVII-LXV.

[21] Kraus, *op. cit.*, II, 228.

This concept of an inversion of the internal and the external surely owes a debt to that groundstone of Aristotle's physics, the passage from potency to act. But Jābir's theory was different in that it reified the Aristotelian doctrine of potency and opened up the possibility of physically locating the ''occult'' and ''manifest'' components of a material respectively in the ''interior and ''exterior'' thereof. As I shall show in due course, this ''localization'' of the occult and the manifest did not, indeed could not, occur until the alchemical writers adopted a corpuscular theory of matter. As long as one viewed mixtures of the elements as being homogeneous and continuous, it would have been nonsensical to localize act and potency. Hence when Jābir uses such seemingly spatial language as ''interior or ''exterior'', he must be interpreted metaphorically.

The alchemists of the thirteenth century did indeed adopt a corpuscular theory of matter, and over a long period of time, this theory converted Jābir's reification of potency and act into one of spatially distinct layers of hidden and manifest corpuscles or components of corpuscles. Whereas Jābir's energies were devoted primarily to the arithmological manipulation of qualities, which he inherited from ancient pharmacology, the main stream of his followers in the West appropriated only the terminology of the occult and the manifest and their spatial synonyms, applying it to their own ends. This was quite natural, since the major Jābirian work that was translated, the *Seventy Books*, contained only a qualitative treatment of the theory of the balance. As we shall see, the theory in this form was to have a long history.

2.2. Geber and the Summa perfectionis

The *Seventy Books* of Jābir was translated by Gerard of Cremona or his assistants in the twelfth century.[23] The alchemy contained therein is one that employs a variety of natural substances. Hair, eggs, and blood, for example, serve as the starting points for producing artificial sal ammoniac, or ammonium chloride. Urine and vinegar provide the basis of strong waters. In addition, Jābir introduces a plethora of "salts"—by which he means any substance that is burnt and then leached to arrive at a lixivium. One major thrust of the work lies in Jābir's desire to analyze the elemental components of the metals and other substances. The strong reagents alluded to above, in combination with operations such as fermentation and distillation, provide the alchemist with his analytical tools: by corroding a given substance, they separate its elemental composition, and free its fire, air, water, and earth. These pure substances, once arrived at, are supposed to work in a highly efficacious manner in producing transmutative elixirs.

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[22] Kraus, *op. cit.*, II, 2.

[23] *Dictionary of Scientific Biography*, XV (1978), Supp. I, 185, for the inclusion of the *L. septuaginta* in the list of translations made by Gerard and his *socii*.

The *Seventy Books* in short provides a microcosm of the rich and powerful technology known to the alchemists of medieval Islam. The work was widely diffused among European readers by the mid-thirteenth century. Indeed, Jābir was so highly regarded that he spawned a variety of imitators in the West. Written under the Latinized form of "Geber", a corpus of Latin alchemy grew up in the thirteenth and fourteenth centuries that in effect tried to supplant the authority of the *Seventy Books.* The chief and original member of this corpus was the *Summa perfectionis* ascribed to Geber. This work, as I have argued elsewhere, was written around the end of the thirteenth century, probably by an obscure Franciscan monk.[24] While the author does not fully understand the *Seventy Books*, he succeeds nonetheless in naturalizing it, by making it conformable to scholastic physics.

Basing himself in part on the *De mineralibus* of Albertus Magnus, the author of the *Summa perfectionis*—Geber as I shall call him—took the radical step of rejecting animal and plant substances in his alchemy. The myriad preparations of blood, urine, and vegetal juices employed by Jābir find no echo in the *Summa perfectionis.* Geber has decided that the alchemist must "follow nature wherever possible", that is, he must use the same principles as does she in transmuting the metals. These principles are mercury and sulfur.[25] Nature congeals mercury within the earth by means of sulfur, to produce the different metals. Only by this means may the alchemist produce metals that can resist the refiner's fire. What is more, mercury contains its own sulfur within itself.[26] Since mercury is not inflammable, like sulfur, the alchemist would therefore do well to avoid any reagent but mercury in preparing his transmutative elixir, now called the "philosophers' stone".

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[24] W. Newman, *The Summa perfectionis of pseudo-Geber*, Leiden 1991, 57-108.

[25] Newman, *pseudo-Geber*, i-iv, 134-8, 204-8.

While Geber still allows the use of "salts, niters, and boraxes" in preparing his mercury, he does not view these as persisting in the final product. They are means of purifying the mercury, but they do not unite with it. Thus Lynn Thorndike dubbed Geber's modus operandi the "mercury alone" theory, as the philosophers' stone is viewed by him as consisting solely of purified mercury, although this mercury still contains a sulfur "inherent" in itself.[27] Geber praises "God the blessed and glorious" for creating mercury, since it is a unique substance in that it can be led to "metallic perfection".[28] Let us now consider how this purification takes place. Geber views mercury, and indeed all mineral substances, as being composed of tiny corpuscles, called "minimal parts" or "subtle parts" (*minima*, or *subtiles partes*).[29] Geber states as a given that bigger corpuscles are more difficult to sublime than their smaller counterparts. But natural mercury is unusual in that its corpuscles are all roughly the same size. Hence upon the application of heat, mercury sublimes without leaving any residue. Nonetheless, naturally occurring mercury does contain heterogeneous impurities, in the form of a "burning sulfur" and a "filthy earth". The alchemist must remove these imperfections while also "drying out" his mercury by subliming it with salt. The result—in Geber's eyes—will be that the mercury becomes even more homogeneous than it was, and that its particles are now more closely packed. As a result, it acquires "fixity", the ability to withstand heat without subliming. This is an essential property for the philosophers' stone, since without fixity, the mercury will not be able to withstand the assayer's fire. Thus Geber says that his mercury is that which "conquers the fire and is not conquered thereby, but rests there in a friendly fashion, taking pleasure in it".[30] In modern terms what Geber has produced is corrosive sublimate, mercury II chloride. He believes, however, that by continually subliming and dissolving this product, he can make its particles attain such minuteness that they will be able to penetrate through the pores of a base metal and transmute it into gold. Geber expresses this increased subtlety in terms of a tripartite scale: he lists "medicines" of the first, second, and third order. The tiny corpuscles of a purified mercury belonging to the third order will infix themselves in the intimate structure of the metal and supply the augment of weight necessary to bring any metal up to the specific gravity of gold. Moreover, the newly entered particles will block the excess pores of base metals that accounted for their erstwhile susceptibility to corrosion, thus making them incorruptible.

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[26] Newman, *pseudo-Geber*, 76ra, 16-23.

[27] Lynn Thorndike, *A History of Magic and Experimental Science*, New York 1934, III, 58.

[28] Newman, *pseudo-Geber*, 75va, 33-8.

[29] Newman, *pseudo-Geber*, 143-67.

[30] Newman, *pseudo-Geber*, 75va, 39-40.

The terminology by which Geber expresses his mercury's ability to penetrate deeply into gold and modify its structure, is not surprisingly the "occult" and "manifest" of Jābir ibn Ḥayyān. Hence he refers to the "depth of the occult" of tin,[31] or simply the "depth" or "profundity" of lead.[32] Inferior medicines cannot cure the imperfection in a metal's "profundity"—this is for those of the third order alone. Mercury itself has a twofold sulfur within itself: one sulfur is "sealed up in the profundity of its substance", whereas the other is "supervenient".[33] The second may be removed by art, but the first, because of its radical nature, is difficult or impossible to eradicate.

It is tempting to argue that Geber himself has attributed a spatial sense to the occult and manifest of Jābir ibn Ḥayyān. In a loose sense this is perhaps true, since the *Summa* speaks of a penetration through the smallest particles (*per minima*) up to the profundity of a base metal. The author may have in mind an agglomeration of particles that can be broken down into smaller components, and that the occult or profound level is attained only with such an analysis. Nowhere does he describe such a second-order composite particle, however, leaving the possibility open that for Geber, the occult and the manifest are still to some degree synonymous with Aristotelian potency and act, and so must be interpreted tropologically.

It is a remarkable fact that the *Summa perfectionis* nowhere mentions the Aristotelian duality of matter and form. Indeed, Geber's explanations are of such a uniformly corpuscular nature that on one occasion at least, a seventeenth-century follower of his has been viewed as participating in a "mechanical re-thinking of alchemy" under the putative influence of the "new science" of the early modern period![34] But Geber was not a mechanical philosopher: as we have elsewhere shown, his sources lie above all in the tradition of the fourth book of Aristotle's *Meteors*, a work of marked corpuscular tendencies. Geber's corpuscular reworking of Jābirian alchemy rationalizes the multifarious processes of chemical technology in full accord with scholastic physics.

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[31] Newman, *pseudo-Geber*, 77vb, 3.

[32] Newman, *pseudo-Geber*, 77vb, 7.

[33] Newman, *pseudo-Geber*, 76ra, 18-19.

2.3. Paracelsus von Hohenheim

The cool rationalism of Geber could not seem more different from the world of the sixteenth century magus Paracelsus von Hohenheim. Composing with such chaotic abandon that he has been accused of writing while inebriated, Paracelsus lays forth a universe in which all matter is ensouled.[35] It is difficult at first to see how a thinker such as Van Helmont could have fused elements from such wildly different systems as those of Paracelsian and Geberian alchemy. In order to understand how he did so, we must first take a glimpse, however briefly, at Paracelsian cosmology as a whole.

Paracelsus is famous for asserting that all things are composed of three principles, mercury, sulfur, and salt. This is in part a reworking of the Arabic theory that metals are made of sulfur and mercury, to which Paracelsus has given a trinitarian twist by adding salt.[36] Indeed, in his *Book of Meteors*, Paracelsus argues that all things are made "from three" because the *fiat lux* by which God created the world was necessarily three-fold,[37] being the expression of the Father, Son, and Holy Spirit. But precisely in this same locus we also learn that there are four elements, which are fire, air, water, and earth, just as in Aristotelian cosmology. Paracelsus argues that these elements act as "mothers" to produce the material world. They are as it were stamped with the trinitarian activity of the three principles.

In a closely related work, the *Book of the Generation and Fruits of the Four Elements*, Paracelsus relates that these four immaterial mothers produce four distinct physical layers in the cosmos, the totality of which he calls Domor.[38] These elemental layers are paired so that the outer one consists of air or "chaos" on its external side, and fire on the internal, while the inner pair is made up of earth on the outer and water within. This is somewhat artificial, however, for Paracelsus admits that products of fire exist in the air, such as the sun which "swims" in the "chaos". Similarly, brooks and streams obviously are found on the earth's surface.

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[34] B.J.T. Dobbs, *The Foundations of Newton's Alchemy*, Cambridge 1975, 82.

[35] D.P. Walker, *Spiritual and Demonic Magic from Ficino to Campanella*, London 1958, 96-7, 101.

[36] Walter Pagel, *Paracelsus*, Basel 1958, 100-4.

[37] Theophrast von Hohenhein, *Saemtliche Werke*, I. Abt., ed. Karl Sudhoff, München 1931, XIII, 134-6.

The outer borders of each element are referred to as its Yliadum. At the internal surface of each sphere, the material element is produced by its "mother", which is evidently intangible, whereas the external Yliadum is the point at which the element "dies" and returns to the immaterial. In typically Paracelsian fashion, however, the Yliadum is not only a physical border; it is also the maturation point of a given elemental "fruit". When a fruit of earth, such as a chestnut tree, grows to the end of earth's Yliadum, it begins to penetrate the sphere of fire, and so dies. The putrefaction of vegetable matter by the heat of the sun, which "consumes" it, is thus viewed as the result of a given "fruit's" trespass on the neighboring elemental sphere: "...each thing, when it arrives at its Yliadum, is subjected to putrefaction, and rots".[39] Thus Paracelsus describes the Yliadum of the earth as not proceeding beyond the surface of the earth more "than the height of growing things."[40] This area is the "lower chaos", which Paracelsus distinguishes from the "upper chaos" where the element of fire is located.

Despite this delimitation of Yliada, the fruits of the respective elements depend on their neighbors:

> ... in the same way as the element of earth holds its fruit in the body of chaos, so the earth is the body that supports the growth, tree, and fruit of the element of water. For there is no element which does not have a body in which it is borne. The chaos bears impressions, the element of fire bears the fruits of the earth, the earth the water, and the water the air, so that the fruit of each element is borne in the other element.[41]

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[38] Theophrastus Paracelsus, *Bücher und Schrifften*, Johannes Huser ed., Basel 1590 [Olms reprint 1972, IV] *Achter Theil*, 55.

[39] Huser, *Achter Theil*, 126.

[40] Huser, *Achter Theil*, 126.

[41] Huser, *Achter Theil*, 124: "Dann zu gleicher weiss/wie das Element *Terrae* sein Frucht im Corpus *Chaos* halt: Also dermassen ist die Erd das *Corpus*, das da auffenthalt/die Gewechs/Beum/und Fruecht dess Baums [dess] Element Wasser. Dann do ist kein Element/es muss haben ein *Corpus*, darinn es getragen wird. Der *Chaos* tregt die *Impressiones*, dz Element Fewr tregt dem Erdtrich sein Fruecht/das Erdtrich dem

Hence there is a symbiosis between the neighboring elements. As Paracelsus says in another ''meteorological'' passage, a tree on the surface of the earth ''fills up the air'', while metals, which are products of water, fill up ''the pores of the earth''.[42] Water and earth can be related to the non-neighboring air because in reality air or ''chaos'', being the realm of God, is present to some degree in all the other elements, and supplies life to them all.[43] The intensely biological character of this doctrine can hardly be overstated. In order to make this yet more clear, let us consider the example of a single element, water. In the case of water, the elemental mother exudes its product, apparently at the core of the earth. The water thus produced then branches out like a vast tree, both to produce mineral veins and to form the rivers of the world. The rivers in turn empty themselves into the sea, where they die and putrefy, to become brine. The image of a watery tree is well described by Paracelsus, and deserves to be quoted—

> [Water] ... goes in its Yliadum up to the surface of the earth, and there finds its height, which is its end ... all the branches terminate their Yliadum in the sea, where all come together. For as there is a root, so it produces a top and umbel: this is the sea. The sea of itself is no trunk or tree, but rather an umbel composed of stalks, and it does not grow immediately from the root, but from the branches.[44]

The emphasis that Paracelsus places on the distal relationship between the canopy, or sea, and the root of the watery tree may be intended to suggest the increasing materiality of the manifested element as it proceeds away from its mother: hence the point of greatest density is also that of its demise and return to the immaterial.[45] Now it is fair to wonder how this fantastic cosmology can relate to the restrained and sober theories of Geberian alchemy. Paracelsus was certainly no corpuscular philosopher, and betrays little first-hand knowledge of Geber. The connection, as I stated earlier, is an indirect

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Wasser/das Wasser dem Lufft/also/das jedes Elements Fruecht in dem andern Element getragen werden''.

[42] Sudhoff, III, 37.

[43] Huser, *Achter Theil*, 61.

[44] Huser, *Achter Theil*, 126: ''... geht in sein *Yliadum* auff die Ebene der Erden/do erwindt sejn hoehi/und ist sein End... alle Est beschliessen ihr *Yliadum* im Meer/do kommens alle zusammen. Dann wie es Ein Wurz ist/also kommt es in Ein Spitz und Dolden/der ist das Meer. Das Meer fuer sich selbst ist kein Stamm/noch Baum/allein der Dolden der Stammen/und wachst nicht auss der Wurtzen fuer sich selbst/sondern was es nimbt durch die Est''.

[45] Huser, *Achter Theil*, 126.

one, and to see it we must return to the Paracelsian image of a giant watery tree. The watery womb has more than one efflorescence, as it produces not only liquid water, but minerals. Thus Paracelsus views mineral veins as being trees or branches in their own right. These subterranean trees have a "harvest" just as their surface counterparts, at which time they too produce "fruits" or "nuts". In a striking example of this organic image, Paracelsus argues that this accounts for the fact that metals have to be refined from their ores:

> There are some trees which give their fruit not pure but mixed, just as a chestnut or the like has an external raw shell, then another, and then a membrane over the kernel. The metals and genera of minerals which are composed of meats and skins are also like this, such as iron ore, silver ore, and other ores, so that one must separate them therefrom if one is to find the fruit within....[46]

It is precisely because the various ores are produced by metallic trees that they do not usually yield metals in a pure state. The ores are literally the "nuts" produced by the subterranean branches, and therefore they must be hulled of their impurities. Now the division of shell, membrane, and kernel resurfaces in other Paracelsian descriptions of minerals as well. In his work *Of Natural Things*, for example, Paracelsus claims that sulfur has a kernel, membrane, and shell. He calls the three types of sulfur "metallic", "embryonic", and "mineral".[47] One can easily see why Paracelsus would have labelled one sulfur "mineral", and allocated it to the external shell, given that many common ores are sulfides which would release their sulfur upon being refined. The "embryonic" sulfur, on the other hand, has a long history in the discovery and use of ethyl ether, since Paracelsus tried to arrive at this sulfur by distilling a mixture of sulfuric acid and ethyl alcohol, arriving at an impure ether. Paracelsus, incidentally, fed this ether to chickens and observed its narcotic properties.[48] As for the metallic sulfur, this is the component of metals that causes their congelation, just as the medieval sulfur-mercury theory would have it.

One can see, at least in rough outline, how Paracelsus' elaborate biological cosmology served him in classing different chemicals, especially sulfur compounds. His method, as so often in this writer, is to apply the macrocosm-microcosm analogy in such a way as to transpose the structure of one natural phenomenon onto another.

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[46] Sudhoff, III, 38.
[47] Sudhoff, II, 126-145.
[48] Pagel, *Paracelsus*, 276-7.

Thus "the tree" becomes a sort of ideal form that finds itself manifested on all levels of existence. This leads us into a delicate problem, namely the question of literalness in Paracelsus' thought. Just how exactly did he propose that minerals mimicked the form of trees, and their "fruit" that of nuts? One can see how in the case of mineral veins, the image has a striking and visual appropriateness. Indeed, native silver is sometimes found in long black formations that really do have the appearance of twisted stalks. But in the case of the "nut", with its tripartite shell, the visual parallelism seems to break down. This would not have bothered a mind like Paracelsus' who believed that men who act in a swinish fashion, for example, really are pigs.[49] To him it is the internal essence of a thing that dominates its being, although the external appearance reveals important clues.

As we shall see, however, certain of Paracelsus' followers were not content with such a tropological association between mineral "fruits" and their surface counterparts. This leads us back to our main theme, which was the association of the Geberian corpuscular theory with the occultum/manifestum complex of his master Jābir ibn Ḥayyān. For the followers of Paracelsus, steeped in the tradition of Geberian alchemy, found nothing more natural than the grafting of his "fruit" onto the more solid body of a Geberian corpuscle. After all, had not Geber himself stated that matter had an "interior" and an "exterior?" What could be more reasonable, then, than to superimpose a nut, with its shell at the circumference and its kernel at the center, onto the image of a single Geberian minimal part? This association was all the more probable in that Paracelsus too equated the external shell with the naturally occurring, visible product, whereas the kernel was something secreted away in the occult recesses of the mineral, demanding a separation by the refiner's art. In order to arrive at a spatially determined particle, one had merely to take Paracelsus' comments about generalized ores and sulfurs, and transpose them onto an individual corpuscle.

This, I believe, is precisely what Van Helmont did. Echoing Geber, Van Helmont states that mercury has two sulfurs, one superfluous, the other intrinsic. The intrinsic sulfur is "very profoundly mixed"[50] to the mercury, and cannot be affected by corrosives.[51] This is all orthodox Geberian doctrine: the reader will recall that the *Summa* spoke of a "double sulfureity" in mercury, one part sealed up in the "beginning of its mixture", the other part "supervenient".[52] But Van Helmont goes on to clothe his Geber in the language of Paracelsus. The supervenient sulfur of Geber here becomes the "external sulfur" of the Paracelsian mineral tree.[53] The intrinsic sulfur of Geber, on the other hand, is now said to exist "in the center", where it makes up "the interior kernel of the mercury".[54] This interior kernel of the mercury "cannot be reached by dissolvents, much less bored out".[55] Thus Van Helmont has fused Geberian corpuscularism with the Paracelsian theory of the mineral tree, in order to arrive at a complex particle with clearly defined internal space.

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[49] Huser, *Zehender Theil*, 13.

[50] Van Helmont, *Progymnasa meteori*, in *Ortus medicinae*, 43, 14.

[51] Van Helmont, *Progymnasa meteori*, in *Ortus medicinae*, 43, 17.

3. Van Helmont's Theory of Mixture

3.1. Minima Naturalia

It should be fairly easy to see how Van Helmont could have married Geberian corpuscularism with the Paracelsian language of "shells" and "kernels" to come up with something rather novel. But the incorporation of Geberian matter theory is not Van Helmont's only debt to medieval corpuscularism. As I shall now show, Van Helmont borrowed important elements from the scholastic theory of *minima naturalia* as well. These borrowings surface in Van Helmont's theory of mixture. Unlike the atomists of antiquity, Van Helmont denies that substances genuinely combine by a juxtaposition of their minute corpuscles.[56] In the *Ortus medicinae*, as also the *Opuscula medica inaudita*, Van Helmont distinguishes between "mere apposition" of particles and true "wedlock". The first is a "bare commingling," which Van Helmont contrasts to the genuine "marriage" that can occur between substances that have undergone "a very deep connecting ... as it were of two sexes".[57] As in modern chemistry, Van Helmont asserts that what we would today call a "mechanical mixture", such as the juxtaposition of sand and grains of salt, is not a compound at all, but a "bare commingling." But here the similarity ends. For where modern chemistry knows of compounds held together by chemical bonds between recoverable elements, Van Helmont speaks of "indissoluble marriages". Only "spirits", that is, volatile substances, can partake of such permanent conjugal bliss, and this in a restricted fashion. If one tries to mix grosser matter, such as water and earth, the result will be a mere "affusion" or apposition, not the sought-for coalescence (*coalitus*)

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[52] Newman, *pseudo-Geber*, 76ra, 16-23.

[53] Van Helmont, *Progymnasa meteori*, in *Ortus medicinae*, 43, 14: "sulphur externum...."

[54] Van Helmont, *Progymnasa meteori*, in *Ortus medicinae*, 43, 17: "... interior Mercurii Nucleus...."

[55] Van Helmont, *Progymnasa meteori*, in *Ortus medicinae*, 43, 17: "... a dissolventibus non attingitur, multo minus terebratur".

[56] A brief but good treatment of ancient atomism may be found in G.S. Kirk, J.E. Raven, and M. Schofield, *The Presocratic Philosophers*, Cambridge 1983, 402-33.

[57] Van Helmont, *De lithiasi*, 24,1 and 18,5.

At first face, then, it sounds as though Van Helmont is proposing that all substances must be volatilized or subtilized before they can be truly combined. This is indeed true to his thought, but one must add the caveat that a mere mixture of spirits is not properly "marriage" as such. What happens, rather, is that the spirits must be *transmuted*, not merely mixed. The following passage explains this nicely:

> When bodies are fully subtilized, so that they cannot be further [reduced], if the subtilizing should continue, they will finally pass into another substance....[58]

The import of this passage is that there is a natural limit to divisibility, beyond which a substance, *qua* substance, cannot pass. If it should surpass that limit, it will then become another substance. The same idea is expressed in the language of atomism, as follows:

> I have found that so often as a body is divided into smaller atoms than the necessity of its substance can stand, a transmutation of that body will continually follow, except in the case of an element.[59]

It is highly likely that Van Helmont is basing himself here on the medieval concept of *minima naturalia*, an offshoot of Aristotelian matter theory. In Book I, Chapter IV of the *Physics*, Aristotle asserts that animals and plants have an upper and a lower size limit, and that the same must be said of their parts.[60] From this rather obscure reasoning, the scholastics concluded that there are *minima naturalia*—smallest natural parts—out of which living, and even inanimate things, are composed. Roger Bacon, writing in the thirteenth century, argued that although matter may be infinitely divisible in principle, the smaller a particle is, the less it can exercise its natural power on others. Thus if a particle of fire, for example, becomes too small, it will lose its power of heating. As a result, the elements *qua* elements have a lower terminus beyond which they cannot be divided. If they should be divided further, they would effectively cease to be elements at all. There can be little doubt that Van Helmont has tapped the *minima naturalia* theory for his own idea of chemical combination. Indeed, the very language of his paradoxical claim that if "the subtilizing" of bodies should be made to continue after "they cannot be further [reduced]", they "will finally pass into another substance", echoes similar claims made by the late thirteenth century follower of Thomas Aquinas, Aegidius Romanus. As Aegidius says, the division of a "natural body" may not proceed into infinity:

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[58] Van Helmont, *Progymnasa meteori*, 42, 7: "Corpora enim dum ad summum subtiliantur, ut amplius non possint, si perseveretur subtiliando, tandem abeunt in aliam substantiam, cum retentione proprietatum seminalium".

[59] Van Helmont, *Imago fermenti*, 72, 23: "Cognovi enim, quoties corpus dividitur in subtiliores atomos, quam suae substantiae ferat exigentia, continuo etiam sequi corporis illius transmutationem, excepto elemento".

[60] Anneliese Maier, *Die Vorläufer Galileis im 14. Jahrhundert*, Roma 1949, 180.

> ... but it will arrive at something which is not divisible in this fashion, and if it should happen that it be further divided, it would be stripped of its own nature.[61]

Van Helmont could easily have been exposed to the works of Aegidius Romanus while a student at Louvain, but there is no need to insist on that point, since the work of Anneliese Maier has shown that the *minima naturalia* theory was widespread among the scholastics at large.

The upshot of Van Helmont's theory is that there is no intermediate state between mechanical mixture and transmutation. A compound such as cinnabar, mercury sulfide, is illusory, since its components are easily recovered by decomposition. As he says himself:

> Although the mercurial part in metals, to the same degree as the body of mercury itself, can on account of additives take on the masks [*larvae*] of vitriol, oil, salt, or water, these are nothing but impostures of the eye. This is because the mercury always returns from these, for it was always present there according to its nature and all its properties.[62]

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[61] Anneliese Maier, *op. cit.*, p. 182: "Si intelligatur in eo quod corpus naturale, sic non vadit divisio in infinitum, immo est devenire ad aliquid quod secundum quod huiusmodi non est ulterius divisibile, et si contingeret ipsum ulterius dividi, expoliaretur a natura sua".

[62] Van Helmont, *Tria prima chymicorum*, 255, 59: "Igitur quanquam pars mercurialis in metallis, adeoque & in ipso Mercurii corpore, propter adiuncta, suscipiat larvas vitrioli, olei, salis, vel aquae: non sunt nisi oculorum imposturae. Quippe semper Mercurius inde redit, quia secundum naturam, & omnes proprietates, semper inest".

In the case of spirits that undergo a radical interpenetration, on the other hand, the result is "an inseparable offspring of mixture, a transmuted product, a third thing from each".[63] In other words, one can have an "offspring of mixture", but not a chemical compound as such. Strictly speaking, Van Helmont's theory replaces the real combination of two volatile substances with transmutation of the two substances into something else. The point may seem pedantic, but it had a vast impact in the direction of laboratory practice: to the Helmontian, two substances that had undergone transmutation could not be reduced into their original constituents.[64] The production of such "compounds"—the existence of which violates the very notion of the chemical compound as we know it—formed a major goal of Helmontian chemistry. Before approaching this subject, however, we must ask a question that has been lurking in the background. If two substances are reduced into such minute corpuscles that they lose their original character, as enunciated above, what relation will the *tertium neutrum,* the product of their transmutation, bear to its progenitors? Since they have lost their original characteristics by virtue of their reduction into "atoms", how can their product be related to them at all?

3.2. Fermentation and Semina

Van Helmont's answer to these questions will bring us directly into his theory of fermentation. As he says in his *Imago fermenti*, "ferments are the predecessors wholly necessary to every transmutation"....[65] Indeed, ferments are the "parents" of transmutation in general.[66] What precisely are the mysterious ferments of which Van Helmont speaks? He defines them thus: "The medial tools by which the *semina* dispose materials, I call ferments".[67] The ferments, then, are instruments by which the indwelling seeds of all things, or *semina*, go about their business. As is well-known, Van Helmont believed that all matter contains these tiny activating particles , or *semina*.[68] Quoting Michael Sendivogius, he says that "every *semen* (according to the chemical Cosmopolite) is barely the 8200th part of its body".[69] Van Helmont goes much farther than Sendivogius in his claims for these seeds, however. According to Van Helmont, it is the *semina* alone that transmute elemental water into the myriad substances that we encounter in the phenomenal world. All things are really made out of water, but water that has undergone the transmutative action of the *semina*: it is the ferments that allow these seeds to work:

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[63] Van Helmont, *De lithiasi*, 25, 7: "...cum permistione radicali, estque constitutum ex ambobus, inseparabilis, mistionis proles, hoc transmutatum, est productum, neutrum ab utroque".

[64] Van Helmont, *De lithiasi*, 19, 13: "Obiter hic adnoto, quod in transmutatis non sit regressus immediatus ad id, unde transmutatum est: non magis quam a privatione ad habitum ... Idcirco enim transmutata servant propriam novi entis essentiam, cum prioris concreti neglectu".

[65] Van Helmont, *Imago fermenti*: 69, 1: "Etenim ut fermenta omnino ad omnem transmutationem praevia, atque necessaria...."

[66] Van Helmont, *Imago fermenti*, 72, 23.

[67] Van Helmont, *De lithiasi*, 29, [5]: "Media autem organa, quibus semina materias disponunt, fermenta voco".

> All bodies primitively and materially draw their origin from water, the semen being acquired by means of ferment. And when the *semina* are lost, the bodies finally return into their former dwelling of water.[70]

It is the *semina*, then, that provide elemental water with specific characteristics of matter as we know it. So what is the role of the ferment? After asserting that fermentation is the parent of transmutation, we found Van Helmont stating that when a body is reduced into smaller "atoms" than "its substance can stand", the body will be transmuted. This transmutation occurs by the following means:

> The imbibed ferment, seizing the foresaid atoms, imbues them with its own alien character, during the reception of which there occur divisions of the particles. The resolution of the matter follows these heterogeneities and divisions of the particles. Chemistry up to now has no doubt digested and prescribed putrefactions so that once a ferment is taken, the particles divide into *minima*.[71]

A ferment, then, is a physical substance having the ability to divide other matter into the minimal particles or *minima* described above. At the same time, the ferment itself is the bearer of the specific characteristics that are imparted to the newly transmuted matter. Elsewhere

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[68] Pagel, *Van Helmont*, 35-95.

[69] Van Helmont, *Complexionum atque mistionum*, 66, 12: "Estque omne semen, sui corporis (iuxta Chymicum Cosmopolitam) vix 8200. pars...."

[70] Van Helmont, *Imago fermenti*, 73, 33: "Corpora cuncta primitive, atque materialiter ex aqua sola fiant; acquisito per fermentum semine, quodque exantlatis seminibus, corpora tandem in pristinum aquae hospitium retrocedant".

[71] Van Helmont, *Imago fermenti*, 72, 23: "Quatenus haustum fermentum, arripiens praefatos atomos, eos alieno sui charactere imbuit, in cuius susceptione fiunt divisiones partium, quas partium heterogeneitas [*sic! edition of Amsterdam 1652, 93, 23 has* heterogeneitates], & divisiones, resolutio materiae consequitur. Hactenus nimirum Chymia digerit, ac putrefactiones praemittit, ut accepto fermento partes dehiscant in minima".

Van Helmont tells us that this imbuing of the "atoms" or corpuscles with a new character can take place in two ways. That is because there are two types of ferment in nature. One type of ferment contains in itself a "flowing aura" (*aura fluxibilis*), while the other acts only as a "beginning of motion" (*initium motus*) or principle of generation. To simplify Van Helmont's discourse, the first type of ferment is endowed with *semina*, whereas the second is not. In the case of the second, seedless type of ferment, "only the odor of the ferment" is absorbed by the matter, and this "odor" is a "contagion from the containing vessel or ambient atmosphere".[72] It is not hard to see that Van Helmont is trying here to explain the difference between sexual and spontaneous generation. Thus the herb basil, when subjected to a ferment with *semina*, produces more basil. But if it should be placed between two bricks, and subjected to the influence of the ambient ferment, it can yield a scorpion.[73]

When Van Helmont speaks of ferments as the imparters of specific characteristics, he is therefore referring to the ferment as a host and purveyer of *semina*. It is the *semina* that are the real sources of material difference, for at the most fundamental level, nothing exists but *semina* and water. The seeming confusion of Van Helmont's account arises from the fact that generation can occur even if the ferment in question does not contain *semina*: in such a case the ferment acts as a prime mover to the act of generation, and the *semina* are simply drawn from the atmosphere or another source.

To go further into Van Helmont's theory would necessitate a foray into his psycho-sexual concept of generation, which would lead us too far astray at present. For the moment, let us instead recapitulate what we have learned so far in this section. Van Helmont views all substances as composed of water acted on by *semina*. The ferments are substances that release, stir up and incite the *semina* to activity, in part by means of a mechanical division of matter into *minima*. We are therefore in a good position to answer the question posed by us several pages ago: what is it that transmutes two juxtaposed substances when they are broken down into smaller corpuscles than their nature can bear? The answer clearly is the *semina*, for even when the bodies have passed into "another substance", their "seminal properties" can be retained.[74] After two substances have been divided into minimal particles, their *semina* are free to act on one another. Only in this fashion might elements be "mixed", as in the following hypothetical example:

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[72] Van Helmont, *Imago fermenti*, 70, 8: "Sunt ergo duplicia fermenta in natura. Unum quidem continet in se auram fluxibilem, Archeum seminalem, qui suo fluxu in animam viventem aspirat. Alterum vero saltem continet initium motus, sive generationis rei in rem". (71, 11) "In prioribus ergo, & vitalibus seminibus, generans inspirat Archeum, cum sui similitudine, & auram vitalem, una cum seminis massa. In posterioribus vero, insufflatur tantum fermenti odor, a vasis continentibus, aut ambientis contagio. Quae ubi rite coaptata fuerint, mox in plantam vel insectam formantur, excitata nimirum aura, ab odore, & fermento fracedinis, quae dein in Archeum rectorem exaltatur".

[73] Van Helmont, *Imago fermenti*, 71, 13-4.

> Therefore earth would have first to lose its own being (*esse*) and be reduced into juice, before it might marry water. The latter impregnated with seed by its embrace, would pass then into the fruit determined by the conceived seed.[75]

The language used by Van Helmont, with such terms as "marry", "conceived", "impregnated", and "embrace", is obviously sexual. In effect, what he has done is to unite the *minima naturalia* theory of medieval scholasticism with the hylozoism of his teacher Paracelsus, to arrive at a vitalistic corpuscularism. But Van Helmont is not content with this fusion of traditions. He adds yet another element to the mix: his knowledge of Geberian alchemy. It was this, as we shall show, that led him to one of the lynchpins of his system, the theory of the *alkahest*.

4. *The Helmontian Alkahest*

It is well known that Van Helmont invented neither the term *alkahest*, nor the idea that this substance could reduce matter into its ultimate constituents.[76] The Paracelsian work *De renovatione et restoratione* already contains the notion that there is a *sal circulatum*—a term used also by Van Helmont as a synonym for the alkahest—which can return substances to their *primum ens* or primordial substance.[77] But Van Helmont proceeded far beyond Paracelsus in providing a theory for the alkahest, and this he did by employing his medieval predecessors. His *Progymnasa meteori* openly reveals that much of Van Helmont's theorizing about the element water is borrowed from comments made in the *Summa perfectionis* about mercury. Asserting that water is the simplest and most homogeneous of substances, Van Helmont states that it is "most similar to the internal mercury of the metals".[78] Paraphrasing the medieval alchemist Geber, Van Helmont says the following:

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[74] Van Helmont, *Progymnasa meteori*, 42, 7: "Corpora enim dum ad summum subtiliantur, ut amplius non possint, si perseveretur subtiliando, tandem abeunt in aliam substantiam, cum retentione proprietatum seminalium".

[75] Van Helmont in fact believed that earth could not be transmuted into water because of its elemental simplicity. He introduces the example only for the sake of discussion. Cf. *Progymnasa meteori*, 43, 11: "Terra itaque, deberet prius suum esse amittere, atque in succum redigi, priusquam aquae nuberet, ut hanc semine impraegnatam, amplectendo traduceret in fructum concepto semini destinatum".

[76] Ladislao Reti, *Van Helmont, Boyle and the Alkahest*, in: *Some Aspects of Seventeenth-Century Medicine & Science: Papers Read at a Clark Library Seminar October 12, 1968*, Los Angeles 1969, 3-19.

> Hence Geber was given the occasion of saying that any humidity in the order of things that is similar to mercury, due to its homogeneous simplicity, will persevere forever in the torment of fire. It will either all fly away, unchanged in its nature, or, if transmuted by seed, the whole will remain in the fire. I confess for my part that I learned of the nature of water under the tutelage of the ferula and caduceus of mercury.[79]

The key idea here is the notion that any moisture similar to mercury will remain unchanged in fire, "due to its homogeneous simplicity". The importance of this simplicity cannot be overstated in Van Helmont's theory of the alkahest. Before proceeding further, let us quote the following singular description of it:

> Chemistry is intent on discovering a body that would play a symphony with us of such purity that it could not be destroyed by a corrupter. And finally religion is stupefied by the discovery of a liquid which, reduced to the smallest atoms possible in nature, would chastely spurn the marriages of any ferment. The transmutation of it is despaired of, as it may not find a body more worthy than itself to which it might be married. But the work of wisdom has created an

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[77] Paracelsus, *De renovatione et restoratione*, in: *Buecher und Schrifften*, ed. Johannes Huser, Basel 1590, *Sechster Theil*, 113 [Olms reprint 1972, III]. For the term *alkahest* Reti, *op. cit.*, 18, gives Theophrast von Hohenheim gen. Paracelsus, , *Sämtliche Werke*, ed. Karl Sudhoff, Munich & Berlin 1930, Vol. III, 25. The reference is to Paracelsus, *De viribus membrorum*, Book III, Chapter 6.

[78] Van Helmont, *Progymnasa meteori*, 42, 8: "Aqua itaque, est interno metallorum Mercurio simillima...."

[79] Van Helmont, *Progymnasa meteori*, 42, 8: "Hinc data *Gebro* occasio dicendi, ullam in rerum serie, humiditatem, Mercurio similem, propter homogeneam simplicitatem, in ignis tormento, sibi perpetuo constantem. Siquidem vel totus, in sui natura immutatus, ab igne evolat: vel totus, per seminis transmutationem, in igne perseverat". Van Helmont is paraphrasing the following passage from Geber (ed. Newman 1991, 75va, 29-33): "Quia igitur argentum vivum propter nullas causas exterminationis se in partes compositionis illius dividi permittit, quia aut cum tota substantia sui ex igne recedit, aut cum tota in illo permanet stans, notatur in eo necessaria perfectionis causa".

> anomaly in nature, which has arisen without the commixture of any ferment diverse from itself. This serpent has bitten itself, recovered from the venom, and henceforth cannot die.[80]

The context of this passage, the reduction of substances to water, makes it quite clear that the unnamed liquor is the alkahest. The import is that the alkahest acts like a catalyst, without itself being acted upon. This is what Van Helmont means when he says that it "chastely" spurns marriage. He reiterates this idea many times, saying that the alkahest is "immortal", "immutable", and capable of acting "without reaction".[81] This is due to the absolute purity of the alkahest, and to the fact that it "has attained the final limit of subtlety in nature...."[82]

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[80] Van Helmont, *Imago fermenti*, 72, 27-28: "Chymia enim indagando sollicita est corpori, quae tantae puritatis symphonia colluderet nobiscum, ut a corrumpente nequirent dissipari. Ac tandem stupefacta est religio, reperto latice, qui ad minimos redactus atomos, naturae possibiles, coelebs omnis fermenti connubia sperneret. Desperata ideo est eius transmutatio, dignius se, corpus non reperiens, cui nuberet: Sed labor Sophiae, anomalum in natura fecit, quod absque fermento commiscibili, a se diverso, surrexit. Serpens seipsum iste momordit, a veneno revixit, ac mori deinceps nescit". This passage is sufficiently obscure and indeed ungrammatical—to make it desirable to quote the German version prepared by Van Helmont's son Francis Mercurius and Knorr von Rosenroth, *Aufgang der Artzney-Kunst (Sulzbach 1683)* [Kösel- Verlag reprint, München 1971], 157: "Die *Chymia* aber ist bemuchet gewesen einen solchen Coerper zu erfinden/der in der Gleichheit einer solchen Reinigheit mit uns uebereinstimmete/dass er von den zerstoerenden Dingen nicht koente gertrennet werden. Und endlich hat sich geistlich und weltlich verwundern muessen/dass man ein Wasser funden/welches in die kleinesten Staeublein als der Natur immer mueglich/gebracht worden/und hernach/ausser der Eh verbleibend/aller Vermaehlung mit einigem Urheb entsaget. Dannenhero hat man verzweifelt an seiner Verwandlung/weil man keinen Coerper gefunden/der vortrefflicher waere als solches selbst/damit man es verehlichen koenne. Aber die Arbeit der Weissheit hat in der Natur etwas ungemeines gemacht/welches entstanden ist ohn Urheb/der sich mit ihm vermischen liesse und von ihme unterschieden waere. Diese Schlange hat sich selber gebissen/ist nach der Vergifftung wieder lebendig worden/und kan hernach nicht mehr sterben".

[81] Van Helmont, *Potestas medicaminum*, 292, 24: "Summus autem atque felicissimus salium est, qui ultimam puritatis & subtilitatis metam in natura attigit, cuncta pervadit, solusque agendo manet immutabilis...." Van Helmont, *Ignota actio*, 204, 11: "Quibus scilicet unicus & idem liquor, Alkahest, omnia totius universi corpora tangibilia perfecte reducit in vitam eorundem primam, absque ulla sui mutatione, viriumque diminutione. A solo autem suo compari, subter jugum trahitur, atque permutatur". Van Helmont, *Arcana Paracelsi*, 481: "Eminentior est eius liquor Alkahest immortalis, immutabilis aqua solvens, & sal circulatus eius, qui reducit omne corpus tangibile, in liquorem sui concreti. *De febribus*, 102, 10: "Quod liquor Alkahest, idem in numero, pondere & activitate tantum valet millesima actione quantum prima. Quia agit sine reactione patientis."

[82] Van Helmont, *Potestas medicaminum*, 292, 24: "... qui ultimam puritatis & subtilitatis metam in natura attigit....

What is unusual about the above passage is the profusion of themes derived from alchemical descriptions of mercury. The *ourobouros* dragon, the serpent that devours its own tail, is an ancient metaphor for quicksilver that was transmitted by the medieval texts.[83] Van Helmont is also drawing on his alchemically colored view of mercury when he speaks of the alkahest as acting "without being acted on", for this property too he attributed to quicksilver.[84] As in the case of his description of water, Van Helmont is borrowing his concept of the alkahest from alchemical descriptions of the "philosophers' mercury", and again one of his major sources is the *Summa perfectionis* of Geber.

If we now return to the passage in which Van Helmont openly cites Geber, several facts will emerge. There Van Helmont said that any humidity that is "similar to mercury" will remain unchanged in fire, due to its "homogeneous simplicity". It is the absence of heterogeneity that makes mercury "impenetrable", preventing its division by corrosive agents.[85] We know, however, from the passages subsequently cited, that the alkahest is just such a humidity "similar to mercury", for it is its purity that preserves it from corruption. The *Summa* spells this out in more detail than Van Helmont, however. According to Geber, purity means above all homoeomerity, the predominance of like particles. Because mercury contains few large "earthy particles", it further escapes the presence of large interstitial gaps in its substance. This ensures that mercury lacks large pores by which corrupting agents, such as fire and corrosive salts, might enter and destroy it.[86]

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[83] The *Liber de aluminibus et salibus*, a translation from Arabic attributed wrongly to Rāzī, and one of the most popular alchemical works to have circulated in the medieval West, says the following of quicksilver: "It is the serpent enjoying itself, impregnating itself, and one day giving birth. It kills all animals by means of its poison. It flees the fire, and kills all things in a long or short time. But quicksilver can by no means be separated [by fire *delendum est*] since it flees the fire. But the sages have invented certain techniques by which it may be made to remain fixed in the fire". (*Das Buch der Alaune und Salze*, Julius Ruska ed., Berlin 1935, 59. Barbara Obrist, *Les débuts de l'imagerie alchimique*, Paris 1982, reproduces several illuminations of more explicitly tail-eating dragons at the illustrations in her book numbered 32, 64, 91, 100. It is not sure, of course, that all of these symbolize mercury.

[84] Van Helmont, *De lithiasi*, 26, 14: "Notetur actio Mercurii absque repassione essentiali substantiae suae. Estque contemplatio magni momenti".

[85] Van Helmont, *Tria Prima*, 254, 53-9: Mercury is "homogeneus, simplex, & indivisibilis...." "Ex sola videlicet aqua elementali, & virtute simplicissimi seminis mercurialis, coaluit in corpus indivisibile, impenetrabile, & inseparabile, quod inter generata par non habet.... Quandoquidem natura non potest penetrare ad dividendum, ubi nullus est nodus, aut heterogeneitas".

[86] Newman 1991, 150.

But there was another factor in the alkahest's ability to withstand corruption—its ''subtlety''. As Van Helmont said above, ''reduced to the smallest atoms possible in nature'', the alkahest ''would chastely spurn the marriages of any ferment''. The same idea was reiterated where Van Helmont argued that the alkahest had ''attained the final limit of subtlety in nature.'' It is not merely purity, therefore, but also the small size of its constituent particles that allow the alkahest to resist the overtures of other reagents. This too comes from the alchemy of Geber. As we have described, Geber's *Summa* lays out a theory postulating that mercury is the primary constituent of metals, but that it is acted upon by sulfur. Ordinary mercury is composed of tiny particles whose close-packing gives it great weight. Let us quote the *Summa*'s description of gold:

> Therefore the very subtle substance of quicksilver led forth to fixation, and the purity of the same, along with the very subtle, fixed, unburning matter of sulfur, is the whole essential matter of gold.... Because it had subtle, fixed particles, its particles could therefore be much compressed; and this was the cause of its great weight....[87]

In part because mercury is composed of such tiny particles, it can be closely packed together, resulting in a great specific weight. Thus subtlety combines with purity to yield gold—a heavy metal resistent to corrosion. Now the goal of alchemical practice, according to the *Summa*, is the acquisition of an ever more subtle ''philosophical mercury'', that can penetrate the depth (*profundum*) of base metals and transmute them profoundly. Thus the philosophers' stone is simply ''vulgar mercury'' that has been further purified and subtilized. Such ultra-pure, subtilized mercury will ''rest quiet in the fierceness of fire'', unmoved by the ardent assault of flame.[88]

Geber's philosophical mercury is surely the model for Van Helmont's alkahest. Like the alkahest, it has been brought to the utmost purity and subtlety possible. And like the alkahest, it can withstand the attack of that ''ultimate'' corruptive agent, fire. Not only did Van Helmont learn of water ''under the tutelage of the ferula and caduceus of mercury'': it was quicksilver that taught him the alkahest. It is not surprising, given the profusion of hints comparing mercury to the alkahest, that Van Helmont's editors viewed quicksilver as the starting material for the "universal dissolvent". The indices to the *Ortus medicinae* contain several assertions that "the alkahest ... is made from mercury",[89] and at one point Van Helmont himself commands that one "abstract the liquor alkahest from vulgar, store-bought mercury...."[90]

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[87] Newman 1991, 725. For a description of the *Summa's* theory of matter, cf. *op. cit.*, 143-167.

[88] Newman 1991, 784.

Whatever Van Helmont's arcane process for procuring the alkahest may have been, it is clear that his inspiration for this marvellous substance came not only from Paracelsus, but from the tradition of Geberian alchemy. Just as Van Helmont appropriated the so-called "atoms" of his mixture theory from the medieval *minima naturalia* theory, so he borrowed the "subtle particles" or *minimae partes* of Geberian alchemy for his description of the alkahest. In either case, Van Helmont's corpuscular tendencies descend from the material theories of the Middle Ages.

5. *Vitalism in Van Helmont*

It would be a gross mistake, however, to think that Van Helmont appropriated these medieval theories unaltered. As we have seen, he grafted his notion of ferments and *semina* onto the *minima naturalia* theory, thereby producing what I called before a vitalistic corpuscularism. To one who is accustomed to seeing the seventeenth century as a period when the "mechanical philosophy" flourished at the expense of older, vitalistic theories, it may come as a shock to find that Van Helmont took the corpuscular theory of Geber—perfectly devoid of hylozoism—and supplied it with the apparatus of his vitalism—*semina* and ferments. The *Summa*, as we will recall, explained the resistence of the internal mercury of metals to corrosion in terms of the close-packing of its subtle particles. It was the density of substance arising therefrom that prevented the entry of corrosive agents.[91] Now Van Helmont appropriated this theory, and added to it the idea that "the internal kernel of mercury" existing at the center of a metallic corpuscle, could not be "bored out" by acids.[92] According to Van

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[89] Van Helmont, *Index rerum et verborum*, reference to *Progymnasa meteori*, 43, 14.

[90] Van Helmont, *De febribus*, 102, 10: "A Mercurio vulgo venali, abstrahe liquorem Alkahest...."

[91] Newman 1991, 143-67.

[92] Van Helmont, *Progymnasa meteori*, 43, 17: "Prout sal in aqua solutum, sal est, manet, et inde repetitur, sine salis mutatione. Quod sane sic non fieret, si dissolvens iungeretur dissolvendo, per minima: & non sisteretur a Mercurio illius concreti. Ergo interior Mercurii Nucleus, a dissolventibus non attingitur, multo minus terebratur".

Helmont, however, mercury does not rely solely on these factors for its impassibility. In the course of rejecting Geber's notion that mercury is composed of mixed water and earth in favor of the view that it is only transmuted water, Van Helmont says the following:

> The grounds of indestructibility are at hand in mercury itself, just as in the elements, since there is to be found in mercury a certain external sulfur, containing the original defect of the metal. Because this is original it is therefore removed with difficulty. Nonetheless, if this is separated by art, say the skilled, the mercury is cleansed of its superfluous sulfur and excess humidity. Thenceforth it can be precipitated in the form of earth by no fire, on account of its very great simplicity, for which it is compared to water.[93]

Here Van Helmont argues that mercury itself has in its original, ''vulgar'' form, a sulfur mixed in, which acts as a corrupting agent. This is why ordinary mercury can be ''precipitated'', that is, made to congeal and fall to the bottom of a sublimatory, by fire alone. Van Helmont views the formation of mercury oxide as the result of an ''innate'' sulfur solidifying its host mercury: here once again he is employing the Geberian ''mercury alone'' theory.[94] Van Helmont says that this sulfur or ''earth'' exists in the ''center'' of the mercury's ''essence''.[95] He goes on to add that the mercury that has been purified of such innate sulfur is ''mercury from mercury'', describing this artificial substance as follows:

> Therefore mercury cleansed of its original stain, and virgin, does not allow itself further to be seized by sulfurs and *semina*: rather it suddenly consumes these and as it were kills them, except for its comrade.[96]

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[93] Van Helmont, *Progymnasa meteori*, 43, 14: ''Estque ideo in ipso Mercurio, prout in elementis, ratio propinqua indestructibilitatis. Siquidem, in Mercurio deprehendi quoddam sulphur externum, originalem metalli labem continens. Quae quia originalis, ideo & difficulter ab eo tollitur. Qua tandem nihilominus per artem separata, aiunt periti, Mercurium superfluo sulfure, & humido superfluo mundatum. Quippe deinceps nullo igni, potest in formam terrae praecipitari, ob simplicitatem sui maximam, qua aquae elemento comparatur''.

[94] Thorndike, *HMES* III, 58. Newman, 1991, 204-8.

[95] Van Helmont, *Progymnasa meteori*, 43, 14: ''Amisit namque terram (idest, sulfur) quae terra in centro suae essentiae....''

[96] Van Helmont, *Progymnasa meteori*, 43, 14: ''Mercurius ergo originali labe mundatus, atque virgo, non sinit se amplius a sulfuribus, aut seminibus apprehendi, quin haec confestim consumat, ac velut conficiat, excepto suo compari''. The curious reference to mercury's ''comrade'' finds its echo in another Helmontian description of the alkahest in his *Ignota actio*, 204, 11: ''Quibus scilicet unicus & idem liquor, Alkahest, omnia totius universi corpora tangibilia perfecte reducit in vitam eorundem primam, absque ulla sui mutatione, viriumque diminutione. A solo autem suo compari, subter jugum trahitur, atque permutatur''.

As one can see, despite the Geberian origin of this passage, Van Helmont makes no recourse here to Geber's use of close-packing and the absence of porosity. It is simply the mercury's virginity, so to speak, that accounts for its resistence to chemical ''marriage''. But why is it that such virginity protects the mercury from insemination? The answer lies once more in Van Helmont's theory of ferments. As the title of his treatise on ferments announces, it is ''the image of the ferment that impregnates a mass with seed''.[97] In his description of the two ways in which ferments can operate, Van Helmont argued that *semina* are produced in sexual generation by the imagination of the progenitor, ''making an image of himself by means of libido''.[98] This doctrine, which makes the production of human seed a direct function of lustful imagination, stems from Paracelsus.[99] As Pagel has put it, the Helmontian theory dictates that ''[a]ll things have their origin in images; images are their architects''.[100] The corollary to this is that without images, there can be no generation. Even in the case of spontaneous generation, Van Helmont thinks that matter, breathing in the ''odor of the ferment'', produces an image that leads to the formation of life.[101] It would seem, then, that Van Helmont thought that his ''mercury from mercury,'' deprived of any primordial stain, lacked the means of engendering libidinious images, or of receiving them from without.

This interpretation receives some support from Van Helmont's theory of disease. Indeed, the corruption of mercury by sulfur can just as well be considered a disease as a generation. Van Helmont argued that disease too is due to *semina*, which attack the body from without. In order to understand what follows, it is necessary to introduce another Helmontian borrowing from Paracelsus, the *Archeus*. The root idea of the *archeus* is—as its name implies—that of a dominating or ruling faculty. The human body has an *archeus*, which governs its unconscious activities. *Semina* likewise have their own *archei*, by which they are directed to specific goals. Thus Van Helmont says the following:

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[97] Van Helmont, *Imago fermenti impraegnat massam semine*, 69.

[98] Van Helmont, *Imago fermenti*, 71, 12: ''Fiunt itaque semina, a conceptu generantis, facientis imaginem sui, per libidinem, vel ab odore fermenti, quod materiam disponit ad ideam rei possibilis''.

[99] Paracelsus, *Das Buch von der Geberung der Empfindlichen dingen in der Vernunfft*, Huser, *Erster Theil*, 337-46. Cf. 339.

[100] Pagel, *Van Helmont*, 24.

[101] Van Helmont, *Imago fermenti*, 71, 12: ''Etenim prout ab odore, materia haurit transmutationis dispositionem: sic ab imagine deinceps fit materiae dispositio, quae fermentum specificum procuret, atque promoveat''. For imagination in generation, see Pagel, *Van Helmont*, 97.

> The *semen* is a substance in which there is an Archeus, which is a spiritual Gas containing within itself a ferment, an image of the thing [to be produced], and above all the preparatory information of the things to be done [in the course of generation].[102]

The *archeus* is therefore a spiritual substance which can reside in a given *semen*. It is the *archeus* that directs the course of generation, and in disease, of corruption. Disease, however, is not merely the result of an invading *archeus* penetrating the human body. Rather disease results when an alien *archeus* or other agent irritates the innate *archeus* already resident within the body. An image of fear or horror is then engendered in the human *archeus* that leads, in a complicated fashion, to illness or even death. Such phenomena as fevers, shaking, and sweats, are the result of the innate *archeus* having become enraged by the invading entity.[103] The upshot of all this is that without the resident *archeus* within the human body—the guardian and ruler of vital processes—disease itself could not take root.

Disease, then, like generation, is due to the imagination of the recipient, although the imagination may be stimulated by external agents. To return to Van Helmont's "mercury from mercury", one may suppose that its absolute purity makes it incapable of imagining the corruption that would result in disease, while also depriving it of the libido necessary for generation. The same is true of Van Helmont's alkahest, modelled as it is on his interpretation of the alchemists' mercury. Because the alkahest is utterly lacking in lust or putridity, it cannot engage in the sympathetic reactions necessary either for generation or corruption.

Van Helmont therefore took two straightforward theories of material composition—the idea of *minima naturalia* and the Geberian view of mercury—and combined them with his own psychologizing view of matter. As in the case of his shell-theory of matter, this involved above all the integration of Paracelsian ideas with those of his medieval forebears. What makes Van Helmont so difficult to understand is the persistence of these older corpuscular theories alongside his own entrenched hylozoism. In the same breath Van Helmont can attribute the production of an indissoluble compound to a transmutation of its "smallest particles" and to its components' lustful desire for coitus. Perhaps this should not surprise us, for as John Henry has shown, the attribution of vitalism to insensible corpuscles was widespread in the generation before Newton. Such natural philosophers as Matthew Hale, William Petty, and Walter Warner were already granting powers or *vires* to matter by the 1670's or before.[104] These active principles imparted, as Hale said, "a kind of life" to their material host, which would otherwise have remained passive.[105] What is surprising, then, is not the presence of vitalism alongside corpuscularism in Van Helmont, but rather the degree to which he was revising the corpuscular theories of his medieval predecessors. As we have shown, Van Helmont started with Geberian alchemy, a tradition that employed neither active principles nor substantial forms. There is very little that a mechanical philosopher in the Boylean sense could have found objectionable about Geber's *Summa*. Van Helmont then took this straightforward corpuscularism and fused it with the *minima naturalia* theory and the Paracelsian language of the shell and kernel. Aside from arriving at an internally ordered corpuscle, Van Helmont's major contribution lay in the vitalistic reform that he brought to bear on his medieval sources. And yet Van Helmont was no less a part of the scientific revolution than Gassendi or Mersenne. Indeed, Van Helmont considered his importation of vitalistic fermentation into matter theory to be an innovation of the highest significance. He claimed in his *Imago fermenti* that before his time, the term "ferment" had been ignored by all but bakers: it was he, Van Helmont, who had brought the term and its ramifications into natural philosophy.[106] All of this suggests that terms such as "scientific revolution" and "mechanical philosophy" may lead us into a false sense of homogeneity about a period where alternate systems could flourish and derive productive ends from quite different means. Instead of conceiving of the sixteenth and seventeenth centuries as the time in which "the scientific enterprise" coalesced to form a "mechanized world system", we should think of the period as one in which rival systems were operating under quite different conceptions of reform. When Van Helmont combined the traditions of Paracelsianism and medieval corpuscular theory he was, in his own eyes, reforming both.

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[102] Van Helmont, *Imago fermenti*, 71, 12: "Semen autem sit substantia, in qua iam Archeus inest, qui et Gas spirituale, continens in se fermentum, imaginem rei, atque insuper notitiam dispositivam rerum agendarum". Cf. Pagel, *Van Helmont*, 96-102.

[103] I am highly dependent on Pagel, *Van Helmont*, 142-6 here.

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[104] John Henry, *Occult Qualities and the Experimental Philosophy: Active Principles in Pre-Newtonian Matter Theory*, in: History of Science, 24 (1986), 335-81.

[105] Henry, 342.

[106] Van Helmont, *Imago fermenti*, 69, 1: "Notitia fermenti, ut nulla in Scholis ieiunior, ita nulla utilior. Fermenti nomen, ignotum hactenus, nisi in panificio: Cum attamen nulla in rebus fiat vicissitudo, aut transmutatio, per somniatum appetitum hyles: sed duntaxat solius fermenti opera.... Etenim ut fermenta omnino ad omnem transmutationem praevia, atque necessaria...." Van Helmont's claim of originality is of course highly overstated. See Pagel, *Van Helmont*, 71-87.

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Vivarium XXXI, 2 (1993) ©E.J. Brill, Leiden

Aquinas and supposition: the possibilities and limitations of logic in divinis[1]

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Medieval theory of supposition, being a part of medieval theory of meaning, has been and remains a subject of particular interest of present-day philosophers. Ever since it was discovered that there are peculiar parallels between modern and medieval theory of meaning, considerable effort has been made to describe its origins and development. The parallel, in short, is a similar distinction between the signification of a word and its actual meaning in use. Frege's conceptual pair of *Sinn* (sense) and *Bedeutung* (reference), like Carnap's pair of *Intension* and *Extension* (*Connotation* and *Denotation*), were discovered to echo the medieval distinctions between *Significatio* and *Appellatio* (around 1100), and between *Significatio* and *Suppositio* (end 12th and 13th century). Among the many present-day efforts to understand the medievals, the work of L.M. de Rijk is eminent. De Rijk suggests two sources for the theory of supposition, itself a part of the *terminist logic* of the *logica modernorum*: the study of grammar and the study of fallacies.[2]

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[1] I would like to thank prof. dr. H.A.G. Braakhuis, prof. dr. David B. Burrell c.s.c., drs. H.J.M.J. Goris, prof. dr. F.J.A. de Grijs, dr. C.H. Kneepkens and prof. dr. H.W.M. Rikhof for their critique. Part of this paper is contained in my *Christ the 'name' of God. Thomas Aquinas on naming Christ*, Louvain 1993.

Quotations are from the edition of Aquinas' work by the *Commissio Leonina*, if available, and otherwise from the edition contained in Busa's *Opera Omnia*. Abbreviations used are Busa's as well, whereas numbers in brackets usually refer to the lines of Busa's edition. Without further reference indicated, reference is made to the *corpus articuli* or *solutio*. *Scriptum super libros Sententiarum Magistri Petri Lombardi* (*SN*), *Summa contra Gentiles* (*ScG*), *Summa Theologiae* (*ST*), *Quaestio Disputata De Unione Verbi Incarnati* (*QDI*), *QD De Potentia* (*QDP*), *QD De Veritate* (*QDV*), *QD de Virtutibus in Communi* (*QDW*), *Quaestiones Quodlibetales* (*QDL*), *Contra Errores Graecorum* (*OCE*), *De Rationibus Fidei* (*OCG*), *Compendium Theologiae* (*OTT*), *In Libros Perihermeneias* (*CPE*), *In Libros Metaphysicorum* (*CMP*; numbers in brackets refer to Marietti's edition), *In Librum Boethii De Trinitate* (*CBT*), *In Dionysii De Divinis Nominibus* (*CDN*), *Super Isaiam* (*CIS*), *Super Epist. ad Romanos* (*CRO*), *Super Evangelium Matthaei* (*REM*), *Super Evangelium Johannis* (*REI*), *Super Epist. I ad Corinthios* (*C1C-R1C*), *Super Epist. ad Ephesios* (*REP*), *Super Epist. I ad Timotheum* (*RT1*); *De Fallaciis* (*DP3*), *De Natura Generis* (*DPG*).

There is however a considerable gap in our knowledge of the theory of supposition. Apart from theologians like Anselm, Abélard, Gilbert of Poitiers and others from the 11th and 12th century, no recent study has been made of the great theologians of the 13th century. I would suggest one reason: another parallel between the Middle Ages and the twentieth century has obstructed our vision, that between Ockham (and Albert of Saxony) and Russell.[3]

Like Russell, Ockham tried to devise a logic which was purely formal, attempting to leave all metaphysics out of it, while accusing his predecessors of doing exactly the opposite, to the detriment of logic itself. Subscribing to the Ockhamist view, present-day philosophers skipped the great philosophers/theologians of the thirteenth century, searching for 12th century anticipations of Ockham's approach. Peter of Spain, who wrote his treatise possibly in the early thirties of the thirteenth century, presented this interpretation with a formidable problem: why does he distinguish a kind of supposition (*suppositio naturalis*) which seems to blur the sharp distinction between signification and supposition? A similar kind of supposition was mentioned by the two other proponents of 13th century logic, William of Sherwood[4] and Lambert of Auxerre. In my opinion, no satisfactory solutions have been found for this problem of textual and historical interpretation. It seems to me that it will be helpful to investigate the natural context of logic in the thirteenth century, which is theology, instead of skipping it entirely just because one doesn't expect anything from it.[5] As it turns out, the theology of Thomas Aquinas gives ample evidence for the need of a semantic concept like natural supposition.

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[2] L.M. de Rijk, *Logica Modernorum. A contribution to the history of early terminist logic*, Assen 1962-1967.

[3] This approach is taken in all general literature on medieval logic, Bochenski excepted; I.M. Bochenski, *Formale Logik*, Karl Alber 1956; Philoteus Boehner, *Medieval Logic. An outline of its development from 1250-c.1400*, Manchester 1952; Alexander Broadie, *Introduction to medieval logic*, Oxford 1987; D.P. Henry, *Medieval Logic and Metaphysics. A Modern Introduction*, London 1972; E.A.Moody, *Truth and Consequence in Mediaeval Logic*, Amsterdam 1953 (1976); Jan Pinborg, *Logik und Semantik im Mittelalter. Ein Überblick*, Stuttgart-Bad Canstatt 1972; De Rijk, *o.c.*; *The Cambridge History of Later Medieval Philosophy*, ed. Norman Kretzmann, Anthony Kenny, Jan Pinborg, Cambridge etc. 1982, the first five chapters, 9-382; cf. also Heinz W. Enders, *Sprachlogische Traktate des Mittelalters und der Semantikbegriff. Ein historisch-systematischer Beitrag zur Frage der semantischen Grundlegung formaler Systeme*, München/Paderborn/Wien 1975 and Carlos A. Dufour, *Die Lehre der proprietates terminorum: Sinn und Referenz in mittelalterlicher Logik*, München/Hamden/Wien 1989.

[4] H.A.G. Braakhuis however has shown that Sherwood's *suppositio habitualis* cannot be identical with Peter of Spain's *suppositio naturalis*, as, among others, De Rijk thought, *The Views of William of Sherwood on Some Semantical Topics and Their Relation to Those of Roger Bacon*, in: Vivarium, XV (1977), 111-142.

This may be one reason for the lack of a study of supposition in the work of Aquinas, yet I see another one as well. Gilbert of Poitiers was 'convicted' on the occasion of a post-conciliar *consistorium* in Reims (1148) on account of four positions which he defended in his commentary on Boethius's *De Trinitate*, three concerned with trinitarian theology and one with christology.[6] Without going into detail, we seem to have here an example of a theologian with remarkable logical skill, who does not want to take leave of the rules of logic when speaking about God. So, he did not consider it convenient to say "God is Divinity" (*Deus est Deitas*), but only admitted of saying "God is through Divinity" (*Deus est Deitate*).[7] No individual is identical with its nature, and even though God's simplicity, precisely stating this identity, be acknowledged, we should not accept this kind of talk. Gilbert of Poitiers did not understand that God's unicity and complete otherness may make imperative a certain type of propositions whose very goal it is to express that God transcends the logic of created things. Bernard of Clairvaux, Gilbert's main opponent, and Peter of Lombard, probably present at Reims in Bernard's company, as well as the Pope, did endorse such a type of propositions. And so did Thomas Aquinas. Aquinas did know of Gilbert's case, and, more importantly, placed divine simplicity at the very beginning of his *Summa Theologiae*. He makes it quite clear that divine simplicity is the major reason why any investigation of God's essence should be entitled *Quomodo non sit*, and it has recently been shown that Aquinas' insistence on simplicity in God - both in its origins as well as in its immediate consequences (the divine attributes and the discussion of the divine names containing Aquinas' thought about 'analogical usage of words') - displays great logical and linguistic sophistication.[8] This leads to the hypothesis that to put profane logic to divine uses poses a considerable challenge to some medievals, and that Aquinas was one of them. So we have the second reason why Aquinas' work has not been the subject of a study of his use of supposition, at least in recent times.[9] It poses too many difficulties. How can we begin to distinguish where, when talking about God One, Triune or Christ, he is fracturing profane logic, and where he is merely developing it?[10] On the other hand, this approach to Aquinas' authorship is relatively new: few interpretations leave room for a grammar of divine mystery; most of them tend to use Aquinas for apologetic reasons.

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[5] Cf. De Rijk: "And when one thinks of method *as* method with its direct implications, one should realize that Thomas in several of those disciplines has accomplished nothing (...), namely those concerning logical, semantical and epistemological problems.", *Middeleeuwse Wijsbegeerte; Traditie en vernieuwing*, Assen/Amsterdam 1977, 183 (my translation - hs).

[6] Cf. Lauge Olaf Nielsen, *Theology and Philosophy in the Twelfth Century; A Study of Gilbert Porreta's Thinking and the Theological Expositions of the Doctrine of the Incarnation during the Period 1130-1180*, Leiden 1982, 30-9.

[7] H. Denzinger, *Enchiridion Symbolorum, Definitionum et declarationum de rebus fidei et morum*, ed. P. Hünermann, Ed. XXXVII, Freiburg i.B/Basel/Rom/Wien 1991, nr. 745. Cf. ST I 28.2. Gilbert was accused of rejecting *Divina natura est incarnata* as well. Cf. section 4.1.

In the following I will try to show the plausibility of such a characterization of Aquinas' authorship: extremely cautious and circumspect when speaking about God in a reflexive manner, not exactly fracturing the rules of logic but pushing it to its limits. The theory of supposition is one of his tools, and an important one. Along the way,

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[8] Cf. David B. Burrell, *Aquinas. God and Action*, London and Henley 1979; Mark D. Jordan, *Ordering Wisdom. The Hierarchy of Philosophical Discourses in Aquinas*, Notre Dame 1986; H.W.M. Rikhof, *Over God Spreken. Een tekst van Thomas van Aquino uit de "Summa Theologiae". Vertaald, ingeleid en van aantekeningen voorzien*, Delft 1988.

[9] I have to add "recent", since neo-thomist handbooks do contain some passages on supposition. E.g. Joseph Gredt, *Elementa Philosophiae Aristotelico-Thomisticae*, Friburgi Brisgoviae 1937 (1951^9), Vol. I: 42-5, Vol. II: 127-34. An excellent although limited and outdated study is Franz Manthey's *Die Sprachphilosophie des hl. Thomas von Aquin, und ihre Anwendung auf Probleme der Theologie*, Paderborn 1937. The theory of supposition is not treated in Robert W. Schmidt s.j., *The domain of logic according to St. Thomas Aquinas*, The Hague 1966. Regarding Aquinas's handling of modes of signification cf. also L.G. Kelly, *God and Speculative Grammar*, in: *L'Héritage des grammairiens latins de l'antiquité aux lumières*, Actes du colloque de Chantilly, 2-4 septembre 1987, Irène Rosier (ed.), Louvain/Paris 1988, 205-13; F. Cunningham, *Speculative Grammar in St. Thomas Aquinas*, in: Laval Théologique et Philosophique, 1961 (17) 76-86; and J. Jolivet, *Eléments pour une étude des rapports entre la grammaire et l'ontologie au Moyen Age*, in: *Miscellanea Medievalia* 13.1, Berlin-New York 1981, 135-64; Cf. also the interpreted bibliography of Albert Keller, *Arbeiten zur Sprachphilosophie Thomas von Aquins*, in: Theologie und Philosophie, 49/2-3 (1974), 464-76.

[10] The fact that Aquinas may be the author of a treatise *De Fallaciis*, does not help here, precisely because his authorship is uncertain, and even if he were the author, it seems to be a work of youth. It's supposed dependency on a work of Peter of Spain is mere guesswork. Cf. Weisheipl, *Friar Thomas d'Aquino*, Washington 1983, 34, 35 and 386; Cf. H.F. Dondaine, preface to the edition in vol. 43 of the *Commissio Leonina*, Roma 1976, 386b: "dans l'état actuel de notre information, il n'apparaît pas exclu que Saint Thomas puisse être à l'origine de l'ouvrage".

I will show why it would be fruitful for philosophers to take the context of the theory of supposition into consideration: there are good theological reasons for developing the concept of natural supposition, while keeping signification and supposition strictly apart.

The first paragraph will elaborate the link between divine simplicity, *mysterium* and the (in)adequacy of talk about God, in order to make intelligible that in Aquinas all analysis of the human way of speaking provides both possibilities and limitations. In the second paragraph I will investigate Aquinas' use of the term *modus significandi* and show that it is linked with supposition. The third paragraph proceeds with a study of the distinction of supposition and signification, a study of the various *modi supponendi* that Aquinas distinguishes and with a comparison of it to three logical tracts from the thirteenth century (Peter of Spain, William of Sherwood and Lambert of Auxerre). Both paragraphs mention the word *naturalis* and so a fourth paragraph will be needed to explain the influence of modes of signification upon modes of supposition, and the double meaning of the term *supponere naturaliter* in Aquinas.

1. A Grammar of Divine Mystery

When the fourth Lateran Council (1215) defines the faith against the Albigens and others, it opens with words that cannot rightly be called a 'definition':

> Firmiter credimus et simpliciter confitemur, quod unus solus est verus Deus, aeternus, immensus et incommutabilis, incomprehensibilis, omnipotens et ineffabilis, Pater et Filius et Spiritus Sanctus.[11]

How can we define the One who is said to be inexpressible and incomprehensible? Aquinas is fully aware of this dilemma, and he opens his *Summa Theologiae* by grasping it: of God we don't know what He is; only what He is not. Question 12 of this first part is devoted to God's incomprehensibility, and question 13 may be said to be devoted to his ineffability. The treatise "on naming God", question 13, represents the linguistic articulation of God's simplicity, treated in question 3 and elaborated in questions 4 - 11. Helen Waddell once called the idea of divine simplicity "perhaps the deepest word of medieval philosophy or religion".[12] In fact it is more of a denial than an informative positive feature of God. It denies any composition of matter and form, of individuality and nature, of being and essence in God. This compositeness of anything created is so familiar to us that even the structure of our language expresses it. And since our nouns cannot be but either concrete or abstract and our enunciations cannot be but composed of subject and predicate, God's single unity cannot be adequately expressed in it. Divine simplicity is a denial of the adequacy of the human mode of signification.

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[11] H. Denzinger, *Enchiridion Symbolorum*, o.c., nr. 800.

[12] *The Wandering Scholars*, London 1927, xxviii.

Aquinas does not use the word *ineffabilis* itself in the context indicated above. He seems to have a predilection for using this word for the second of the two principal divine mysteries, that of the union of God and man in Christ. To give one example out of a lesser known tract:

> Quodam ergo incomprehensibili et ineffabili modo dicimus Deum fuisse unitum humanae naturae in Christo non solum per inhabitationem, sicut ceteris sanctis, sed quodam singulari modo, ita quod humana natura esset quaedam Filii Dei natura (*OCG* 6 [102]).

The expression 'The Son of God is a man', is an incomprehensible and ineffable expression. When taken literally, the phrase 'ineffable expression' is a contradiction in terms, and so Aquinas intends to say that our words fall short of adequately expressing this unique person:

> Et cum habeat ab aeterno divinam naturam, non per modum compositionis, sed simplicis identitatis, dicitur etiam hypostasis vel persona divinae naturae, secundum tamen quod divina humanis verbis exprimi possunt (*o.c.* 6 [205]).

Both the union itself, as well as Christ's being identical with his divine nature, are comprehended under the term 'ineffable'. So we see that divine simplicity plays an important role in christology as well, by calling attention to our (lack of) knowledge and ability to express adequately what we believe.

Aquinas is not usually that explicit in providing his readers with disclaimers of his insights. This is however only the surface of his texts. One can easily mistake Aquinas' use of the word *mysterium* with a technical usage of terms, as though for him to speak about 'the incarnation' would be the same as to mention 'the mystery of the incarnation'. Close scrutiny of his texts reveals the opposite. According to Aquinas, the sum of the Christian faith consists of two mysteries: the mystery of God One and Triune, and the mystery of the Incarnation. All articles of faith revolve around these two mysteries. We are not dealing here with a temporary, terrestrial handicap, which will be lifted when God will be 'all in all'. The beatific vision will be a vision of the One who dwells in an inaccessible light, who is and remains the Incomprehensible. Revelation is the revelation of the Hidden One. Aquinas links this epistemological stance with his doctrine of the sacraments, with the way Jesus Christ teaches, and with the way the Bible signifies. We should read Holy Scripture in the same way, in which the Old Testament spiritually signifies what is described in the New Testament, which is the same way in which Jesus taught, i.e. in parables and likenesses: *secundum mysterium*. The way in which Christ is present in the Old Testament, resembles the way in which Christ is present in the sacrament of the Eucharist: *secundum mysterium*.[13]

Far from being a technical term, the use of the word *mysterium* expresses a deep-felt and omnipresent theological attitude and conviction. God is ever greater than we can know and say, ever greater than that which our modes of understanding and our modes of signifying can attain.

2. *Modes of signification and signifying the Divine*

Aquinas did not possess a theory of the modes of signification, in the sense in which the speculative grammarians expounded one in their treatises *de modis significandi*, composed at the end of the 13th and beginning of the 14th century. These so-called *Modistae* were engaged in a project in which they tried to justify grammar by way of correlating modes of being with modes of signification, expressing a typically medieval conviction that there exists a certain isomorphy between reality and language.[14]

We know little about the development and sudden break-down of speculative grammar, and about the relationships among its proponents.[15] We know even less about Aquinas' relationship to them.

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[13] Cf. my paper *Aquinas' use of* Mysterium *as a theological reminder*, in: *Jaarboek 1990 Thomas Instituut te Utrecht*, Utrecht 1991, 24-48.

[14] The best visual representation of this isomorphy that I know of can be found in: H. Roos, *Die Modi Significandi des Martinus de Dacia*, Münster/Kopenhagen 1952, 153-9. Consider also Dufour, *o.c.*, 77 where a more general scheme is given. In general cf. F. Crowe, *St. Thomas: The isomorphism of human knowing and its proper object*, in: Sciences Ecclésiastiques, 13 (1961), 167-190.

[15] The latest 'Forschungsbericht': G.L. Bursill-Hall, *The Modistae revisited*, in: *L'Héritage des grammairiens latins de l'antiquité aux lumières*. Actes du colloque de Chantilly, 2-4 septembre 1987, Irène Rosier (ed.), Louvain/Paris 1988, 215-32; cf. also Irène Rosier, *"O Magister ...", Grammaticalité et intelligibilité selon un sophisme du XIIIe siècle*, in: Cahiers de l'Institut du moyen-âge grec et latin, 56 (1988), 1-102; and of the same author the interesting *Signes et sacrements; Thomas d'Aquin et la grammaire*

The earliest of the Modistae seems to be Martin of Dacia. Concordance research of Aquinas' texts, looking up Martin's key-terms[16] in Aquinas, does not admit of any relationship. So it seems that Aquinas belonged to a pre-modistic phase.[17] He does use *modus significandi* in a technical manner, but without systematic organization.

Aquinas' actual use of the terms *modus significationis* and *modus significandi* reveals a wide spectrum of contexts and meanings. The use that medieval grammarians make of Priscian's well-known definition of *nomen*, leads Aquinas to the observation that there is a mode of signification that grammarians discern: *significare substantiam cum qualitate.*[18] This feature distinguishes a noun from a verb and a participle. A verb expresses an action, and an action is always of someone or something, and therefore never exists by itself or is thought to exist by itself and thus is never to be signified as such. Nouns differ from verbs and participles, but they also differ from demonstrative and relative pronouns.[19] Apart from these basic distinctions between modes of signification of separate grammatical classes of words, Aquinas knows of at least 23 other distinctions between modes of signification:

1) the distinction between male, female and neutral words[20]
2) the distinction between substance and accident as expressed in words[21]
3) the distinction between different times of a verb[22]
4) the distinction between potency and act as expressed in words[23]
5) the distinction between an operation and its object or result as expressed in words[24]

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spéculative, in: Revue des Sciences Philosophiques et Théologiques, 74 (1990), 392-436.

[16] These are the terms that were checked: *in modum communis, in modum appropriati, in modum per se stantis, in modum adiacentis alteri, per modum generalem, per modum specialem, per modum ornantis coniuncta, per modum unientis coniuncta.* Most of these phrases do not occur in Aquinas, and if they occur they do not have a logical or grammatical meaning. According to Pinborg, *Die Entwicklung der Sprachtheorie im Mittelalter*, Münster/Kopenhagen 1967, 69 note 19, Aquinas did not know the texts of the modistae.

[17] So says Pinborg, *Die Entwicklung*, 48 and 69 (note 69). Cf. Manthey, *o.c.*, 183 and 198.

[18] *CPE* I 1 + 4 + 5; 1*SN* 9.1.2; 1*SN* 22.1.1 ad 3; 3*SN* 6.1.3; *ST* I 13.1 ad 3; III 78.5.

[19] *ST* I 13.1 ad 3; 1*SN* 22.1.1 ad 3.

[20] 1*SN* 9.1.1 ad 2; *DP*3 10; cf. *ST* I 31.2 ad 4; *ST* III 17.1.

[21] 1*SN* 9.1.2; 22.1.1 ad 3; *QDP* 7.4 ad 1,2; 8.2.

[22] 1*SN* 9.2.2 ad 2; 1*SN* 22.1.1 ad 3; more regularly called *consignificatio.*

[23] 1*SN* 18.1.2.

[24] 1*SN* 10.1.2 ad 3; *ST* I 37.1 ad 2; *ST* I 41.4 ad 3; *QDV* 23.1 ad 7 + 11; cf. *QDV* 23.4 ad 7 and 1*SN* 18 *expositio textus.*

6) the distinction between concrete and abstract nouns[25]
7) the distinction between absolute and relative modes of signification of words[26]
8) the distinction between form and subsistence as expressed in words[27]
9) the distinction between affirmation and negation[28]
10) the distinction between active and passive modes of verbs[29]
11) the distinction between different cases[30]
12) the compositeness of a proposition is its peculiar mode of signification[31]
13) the distinction between words that imply a certain *habitudo* or *relatio* and those that do not[32]
14) the distinction between property, substance and relation as expressed in words[33]
15) the distinction between words that imply change, and those that do not[34]
16) the distinction of number[35]
17) the distinction between prepositions such as *per* and *ab* that imply a relation, and those that do not[36]
18) the distinction between relation and accident as expressed in words[37]
19) the distinction between substance and essence as expressed in words[38]
20) the distinction of all ten Aristotelian categories as expressed in words[39]
21) the distinction between signifying as a whole, and as a part, resulting in predication *recto* and *obliquo*[40]
22) the distinction between substantive and adjective terms[41]
23) the distinction between operation and form as expressed in words.[42]

One is tempted to distinguish those instances where the phrase "as expressed in words" is used from the rest, and to make two separate lists: grammatical and logical modes of signification. As a matter of fact, Aquinas himself distinguishes a logical from a grammatical understanding of the categories. The proper understanding is the one held by the logician, and the grammatical understanding is accepted *quantum ad modum significandi*. Whiteness is grammatically a substance, but logically an accident.[43] But to distinguish a grammatical meaning from a logical meaning of a word is not the same as distinguishing a grammatical mode of signification from a logical mode of signification. In fact, there is no such thing as a logical mode of signification. All modes of signification belong to grammatical analysis. Some modes of being (the ones which the logician discerns and expresses) are reflected in the grammatical modes of signification, and others are not. Some grammatical modes of signification reflect modes of being while others do not. For instance, some passive verbs reflect real passion of the subject of the verb, but others do not.[44] It is not the job of the grammarian nor of the logician, but of the philosopher or the theologian to determine whether modes of being are reflected in modes of signification, or not.

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[25] 1*SN* 4.1.2; 22.1.2 ad 4; 24.2.2 ad 2; 33.1.2 *sol.* + ad 4; 3*SN* 4.2 ad 2; ScG I 30.3; *ST* I 39.4; I 39.5 *corpus* + ad 3; III 16.5 ad 1; *QDP* 7.2 ad 7; 8.3 ad 10; *REI* I 1 [557]; *OCE* 1.4 [75]; *CMP* VII 1.8-12 (1252-1256); cf. *QDP* 8.2 ad 7; *CPE* I 4.5.

[26] 1*SN* 23.1.3 *ad sed contra*; 32.1.1 ad 1; *ST* I 29.4; *QDP* 9.6 ad 2; *REI* I 1 [796]; cf. *QDP* 9.4.

[27] 1*SN* 26.1.1 ad 3; 34.1.2 *sol* + ad 1; cf. *ST* III 2.2 ad 1; I 40.3.

[28] 1*SN* 34.3.2 ("...cum convenientissimus modus significandi divina sit per negationem"); *ST* I 13.12 ad 1.

[29] 1*SN* 40.1.1 ad 1 (Parma-edition); 2*SN* 35.1.1 ad 5; 4*SN* 38.2.3.1 ad 2; *ST* I 41.1 ad 3; I 54.1 ad 3.

[30] 1*SN* 41.1.5 ad 3.

[31] *ST* I 13.12 ad 2 + 3.

[32] *ST* I 19.2 ad 1.

[33] 1*SN* 23 *expositio textus*; *ST* I 40.1; cf. *ST* I 41.1 ad 2; *QDP* 8.2.

[34] *ST* I 45.2 ad 2.

[35] *ST* III 3.7 ad 2.

[36] *QDP* 1.1 *obiectum* 5, *corpus* and ad 1 + 6.

[37] *QDP* 8.2; cf. *DP3* 10.

[38] *QDW* 1.11 ad 4; cf. *DP3* 10.

[39] *DP3* 10.

[40] 1*SN* 25.1.1 ad 3; *QDL* 2.2.2 *ad sed contra.*

[41] 1*SN* 9.1.2; *ST* I 39.3; cf. 3*SN* 5 *expositio textus*; *ST* I 39.5 ad 5.

[42] 1*SN* 32.2.1.

Almost every instance in which Aquinas uses the phrase *modus significandi* represents this kind of activity: to map the differences between God and our deficient mode of signifying him and his operations. The prepositions *per* and *ab* in sentences such as *Operatio divina est ab essentia divina* and *Deus operatur per essentiam suam* imply a relation between divine operation and divine essence, contrary to divine simplicity, but this only belongs to the human level of thinking and the human way of speaking.[45] The grammar of 'to create' and 'to make' is the same, but in reality the latter implies change, whereas the former does not.[46] When talking about the divine persons, we use substantive terms that have a substantive mode of signification, implying substances, whereas there are not three substances in God, but only three relations.[47] These are only three examples out of many instances in which Aquinas calls attention to the modes of signification in order to determine where it is that our language *in divinis* fails, and which rules should be followed in order to give a true interpretation of authoritative statements.[48]

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[43] 1*SN* 22.1.1 ad 3; cf. 2*SN* 35.1.1 ad 5 and *ST* I 41.1 ad 3; cf. 4*SN* 38.2.3.1 ad 2 and *DP*3 8.

[44] 1*SN* 40.1.1 ad 1 (Parma-edition); 4*SN* 38.2.3.1 ad 2; *ST* I 41.1 ad 3.

[45] *QDP* 1.1 *obiectum* 5, *corpus* and ad 1 + 6.

[46] *ST* I 45.2 ad 2.

[47] 1*SN* 23.1.3 *ad sed contra*; *ST* I 29.4.

[48] For instance, when Augustine says that *persona* signifies a substance, Aquinas interprets him as saying that it signifies *per modum substantiae*, not substance itself; 1*SN* 23.1.3 ad 1; cf. *OCE* 1.4.

This procedure usually takes the form of a semantic distinction between what is *realiter/secundum rem/re* the case, and how this state of affairs differs from the state that our mode of signifying or our mode of thinking suggests: *secundum modum significandi* and *rationis tantum/secundum rationem/ratione*.[49] Of the same object we can have e.g. physical, geometrical and grammatical knowledge, and so it is that we need different concepts and different words to understand and express this object. In this respect our knowledge and speaking is never perfect.[50] When we try to understand God, and speak about him, we are faced with a similar problem. Moreover, all our language bears the marks of a language apt for signifying creation, and so our mode of signifying always *importat conditiones corporales* such as time and compositeness[51]. E.g. words such as 'father' or 'principle' with which we signify God are always taken from our discussion of creation. And so Aquinas distinguishes the mode of signification, which in this case is the general feature of being taken from creation-talk, *imponere a quo*, from what we intend in using these words, the result of *imponere ad quem*.[52] Indicating the importance of this general distinction, Aquinas says:

> Respondeo dicendum, quod sicut supra dictum est, sapientia et bonitas, et omnia huiusmodi, sunt omnino unum re in Deo, sed differunt ratione; et haec ratio non est tantum ex parte ipsius ratiocinantis, sed ex proprietate ipsius rei. Ad cuius rei evidentiam, ut diligenter explicetur, quia ex hoc pendet totus intellectus eorum quae in I libro dicuntur, quatuor oportet videre (1*SN* 2.1.3).

All of our understanding of what is contained in Peter of Lombard's first book, depends on understanding the distinction between *res* and

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[49] This displays Aristotle's basic tenet that our words signify concepts, which signify things: "voces sunt signa intellectuum, et intellectus sunt rerum similitudines", *ST* I 13.1; cf. *CPE* I 2; the human mode of signifying follows the human mode of 'receiving' God's perfection in the created world: 1*SN* 22.1.2 *sol* + ad 1; *ST* I 13.3.

[50] 1*SN* 35.1.1 ad 2; cf. 1*SN* 2.1.3; *ST* I 13.4.

[51] *ST* I 13.3 *corpus* + ad 3.

[52] Some names signify that from which they are taken, and in that case they are taken directly from the essence of the thing to be signified. Some however are taken only from a property or a superficial aspect of the thing to be signified, and in that case etymology and signification are not identical. All names for God are taken from creation, so all of them belong to the second category.

Note that this distinction from *imponere a quo/imponere id cui* is also used to distinguish signification (*a quo*) from supposition (*id cui*) in 1*SN* 2 *expositio textus* and 3*SN* 6.1.3; 1*SN* 22.1.2; 22 *exp.textus*; 23.1.2 ad 1; 24.2.2 ad 2; 25.1.2 *sol* + ad 3; 29.1.1 ad 1; 34 *exp.textus*; *ScG* I 30.3; *ST* I 13.2 ad 2; I 13.6; I 13.8; I 13.11 ad 1; I 33.2 ad 4; *QDP* 7.4 ad 1 + 9; *CPE* I 4.9; cf. *ST* II-II 1.6 ad 3; II-II 92.1 ad 2; *CDN* I 1 (029).

ratio, *ratio* being a name of second imposition, i.e. a name for a human concept of a thing insofar as it represents a human intention: names like *genus*, *definitio*, or *suppositum*. We shall return to this shortly.

In order to signify God, we have to fulfill an impossible task: to transcend the very mode in which we speak. Aquinas sums it all up for us in this argument from a discussion of divine simplicity:

> Modus significandi in dictionibus quae a nobis rebus imponuntur sequitur modum intelligendi; dictiones enim significant intellectuum conceptiones, ut dicitur in principio ''Periher''. Intellectus autem noster hoc modo intelligit esse quo modo invenitur in rebus inferioribus a quibus scientiam capit, in quibus esse non est subsistens, sed inhaerens. Ratio autem invenit quod aliquod esse subsistens sit: et ideo licet hoc quod dicunt esse, significetur per modum concretionis, tamen intellectus attribuens esse Deo TRANSCENDIT modum significandi, attribuens Deo id quod significatur, non autem modum significandi (*QDP* 7.2 ad 7).

Apart from explaining how the attention to modes of signification fits in with a typical theological outlook, this list of modes is given here because of this twentyfourth and final mode of signification which Aquinas discerns, and which underlines a basic characteristic of most of the modes earlier mentioned:

> 24) the distinction between being signified as a *suppositum* and as a form.[53]

Each nature is individuated by matter. Such a nature is the form of the individual, and the individual is the *suppositum* of the form. Socrates is a *suppositum* of human nature, and therefore when we say 'Socrates is a human being', human nature is the form of Socrates. 'Human being' however is not the form itself, nor does it have the mode of signification of a form, although 'human nature' does. For obvious reasons we cannot say 'Socrates is human nature'. But can we say 'Socrates is of human nature'? Only when an adjective is added, as in sentences such as *ista mulier est egregiae formae* or *iste homo est perfectae virtutis*. A thing that *has* a certain form, can only be signified to *be of* a form, when a special determination is added. This is a mode of being of created things that is reflected in our mode of signifying: the subject-term is signified as the thing having a form, and the predicate as the form that is had. The subject-term stands for the thing having a form, and this thing-as-being-signified, as actually referred to, is called *suppositum*. It is a creational mode of signification that we cannot but follow, indeed have to follow, when we think about the relationship between the three divine persons. The Council of Nicea endorsed *homoousion*, and Aquinas approves of its Latin translation as *unius essentiae*, employing the line of argumentation just mentioned. Aquinas takes the isomorphy of language and reality very seriously, and does not simply accept a phrase that seems to put the real state of affairs upside down: a nature does not have the individual, but the individual has a nature. Therefore, without special determination, *persona est essentiae* (note the shorthand-character of this phrase) is not admitted, whereas *essentia est personae* is.[54]

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[53] 1*SN* 33.1.4 *sol.* + ad 4; *ST* I 39.2; I 40.1 ad 2 + 3; cf. *ST* I 32.2 ad 2; I 40.2; cf. also *QDP* 8.2 ad 7 where *per modum suppositi* is distinguished from *in abstracto*.

Being signified as a *suppositum* means being signified as something having a nature, or as something performing a certain kind of action.[55] Being signified as a *suppositum* is a certain mode of signification. When a word has supposition, something is signified as a *suppositum*. Something being a *suppositum* means that it is signified by a word that has supposition.[56]

Looking back now upon all the modes that we encountered in Aquinas' writings, we recognize the distinction between being signified as a *suppositum* or as a form in at least fifteen other distinctions. The driving force behind them all is to determine a way of speaking that conforms to the thing spoken about: is it a subsisting thing or an aspect of such a thing. This makes supposition belong to the heart of the theological use of the doctrine of the modes of signification.[57]

And so it seems that there exist a link between modes of signification and the theory of supposition, and that supposition can be defined as a mode of signification. Being a mode of signification, the laws of supposition should both be respected *in divinis* and be provided with a disclaimer: it does not imply any composition in God, it does not imply that God's mode of being concords with the modes of being implied by the mode of signification supposition is. It leaves us with a burning question though. If supposition is a mode of signification, and if modes of signification form part of the larger concept of signification, how does Aquinas account for the difference between supposition and signification?

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[54] *ST* I 39.2.

[55] ST I 40.1 ad 3; the phrase *actiones sunt suppositorum* is axiomatic in Aquinas and omnipresent.

[56] The main arguments for accepting *suppositum* both as an "ontological subject", the common view, and as a result of a rational operation, are these:

a) Aquinas' clearly demonstrated presupposition of the isomorphy of language and reality, a presupposition demonstrated by the very process of distinguishing the *res* from the *modus*, and by the very discussion of the appropriateness of human modes of signification *in divinis*;

b) Several texts indicate that Aquinas accepts *suppositum* as a *nomen secundae impositionis*, a secondary intention, i.e. concept of a concept, existing only in the mind, even though there may be, or even should be, a *fundamentum in re*; 1*SN* 2.1.3; 26.1.1 ad 3; 3*SN* 6.1.1.1; *ST* I 29.2; *QDI* 2; *DPG* 6 [328].

[57] Please note that the survey of modes of signification that I have given covers only those texts in which Aquinas himself explicitly uses the phrase *modus significandi/significationis*. There are many more texts in which he distinguishes *per modum* x from *per modum* y which seem to be pertinent to the theory.

3. Modes of supposition and referring to the Divine[58]

3.1 Some examples of semantic analysis

One and the same word may have different meanings in different contexts. The interpretation of Scripture, fathers or other written sources as well as proper reasoning needs to be alert. One reason may be that the signification or *ratio nominis* is equivocal or analogical. Another reason may be that a different mode of signification causes a different mode of supposition. E.g. *alius* and *aliud* have the same meaning, i.e. *alietas*, but a different mode of signification, and therefore a different mode of supposition, which causes *Pater est alius a Filio* to be true, but *Pater est aliud a Filio* to be false.[59] *Humana natura* and *homo* have the same meaning, but one signifies abstractly and the other concretely. Therefore *Deus assumpsit hominem* is false, since it implies that the hypostatic union took place by way of adoption of an already existing individual, but *Deus assumpsit humanam naturam* is true.[60] This illustrates the basic necessity to develop doctrines of signification, modes of signification and modes of supposition.[61] Quite regularly one finds Aquinas giving a reverent exposition of some *auctoritas* and prohibiting to extend speech in such a way.[62] Also quite regularly one finds Aquinas detecting a fallacy in the opponent's argument, based on a different signification or a different supposition.[63] *Deus assumpsit humanam naturam* also illustrates that signification and supposition should be distinguished. Because *humanam naturam* does not have (personal) supposition, but only signifies the form or nature as such, such a proposition truly expresses the personal unity in Christ. Because there is only a difference in supposition between *Deus generat* and *Deus est genitus*, and not in signification, they do not express that Father and Son are different Gods. Because only the supposit which is denoted by *homo* in *Iste homo est Christus* is different from the one denoted in *Iste homo est Socrates*, and not its signification, Christ's human nature is the same nature as the one all human beings participate in.[64]

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[58] It should be noted that all lists of texts that are given below, are intended to be exhaustive, unless indicated otherwise.

[59] 1*SN* 9.1.1 ad 2.

[60] *ST* III 4.3 *corpus* + ad 2 and 4.4.

[61] Aquinas occasionally talks about *modus supponendi*: "Sed differunt (*relatio* and *hypostasis*) secundum modum significandi, qui fundatur in re, quia utrumque nomen habet veram significationem suam in Deo; et ideo differunt etiam quantum ad modum supponendi, quia supposito uno non supponitur aliud. Sicut enim dicimus quod Deus generat et deitas non generat: ita dicimus quod hypostasis distinguitur et relatio distinguit", 1*SN* 26.1.1 ad 5; cf. 1*SN* 5 *expositio textus*.

In fact, the whole of christology is built on the distinction between signification and supposition. If *homo* in *Homo est Deus* were to signify and supposit the same, the result would be an identification of both natures. *Homo* signifies human nature, but supposits for the individual that has human nature, i.e. the Son of God. If *Deus* in *Deus est homo* were to signify and supposit the same, the distinction between the three divine persons would be lost. *Deus* signifies divine nature, but in this case supposits for one of the individuals that 'have' divine nature, i.e. the Son of God.

3.2 The distinction between signification and supposition

To keep signification and supposition apart is of major interest. But doesn't the fact that, as has been shown, supposition is the heart of Aquinas' usage of modes of signification, blur this distinction? I do not think so. In fact the word supposition has (in this respect) two different meanings say both William of Sherwood and Lambert of Auxerre:[65] one indicates a certain mode of signification, and the other what nowadays is called denotation or extension.

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[62] One example out of many: Pope Innocentius III has said about the Son of God: "persona consumpsit personam", but since no existing person was assumed in the incarnation, this can only be understood as improper use of words; the words mean that the human nature that was assumed did not have a personality of its own; Aquinas says: "Unde non est ex hoc extendendum", 3*SN* 5.3.3 ad 4.

[63] One example out of many: this is a *fallacia figurae dictionis vel accidentis*: "Deus est ingenitus, Filius est Deus, ergo Filius est ingenitus"; in the first proposition *Deus* supposits for the Father, whereas in the second proposition *Deus* signifies the divine nature; *secundum rem* person and nature are identical in God, but not *secundum modum significandi*; *ST* III 3.6 ad 3.

[64] This is expressed by: "Diversitas suppositionis non facit aequivocationem, sed diversitas significationis": 3*SN* 6.1.3 ad 1; cf. *ScG* IV 49.12; *QDP* 9.4 ad 6; *QDI* 2 ad 4; *QDL* 3.2.2 ad 1; cf. also *ST* I 13.9; *OTT* I 211 [137].

Sherwood gives definitions of four *proprietates terminorum* (5.0.1-5.0.2):

significatio	*praesentatio alicuius formae ad intellectum*
suppositio	*ordinatio alicuius intellectus sub alio*
copulatio	*ordinatio alicuius intellectus supra alium*
appellatio	*praesens convenientia termini, i.e. proprietas, secundum quam significatum termini potest dici de aliquo, mediante hoc verbo 'est'*

He draws attention to the fact that supposition and copulation *dicuntur multipliciter, sicut multa huiusmodi nomina, aut secundum actum aut secundum habitum*. The definitions just given are definitions of actual supposition and copulation, whereas the following are definitions of habitual supposition and copulation:

suppositio	*significatio alicuius ut subsistentis. Quod enim tale est, natum*[66] *est ordinari sub alio.*
copulatio	*significatio alicuius ut adiacentis. Quod enim tale est, natum est ordinari supra aliud.*

It is quite clear that habitual supposition is a mode of signification. Sherwood gives further clarification of this point by linking supposition with substantives, pronouns and words used substantively only. All words that can supposit have signification, but not all words that have signification can supposit: only those that *significant rem ut subsistentem et ordinabilem sub alio*. When Sherwood continues with his exposition of the varieties or modes of supposition, it is not in the sense of habitual supposition i.e. as a mode of signification that he uses the word, but in the sense of actual supposition.

Lambert of Auxerre points out that signification is prior to supposition, since supposition is the property of terms that already have signification. Both are further distinguished inasmuch as signification only regards the understanding of the thing to be represented by a word, whereas supposition regards also the *supposita contenta sub illa re*, i.e. the things of which the word can truly be said.[67] Lambert continues by pointing out that the word supposition has different meanings, two of which are relevant here:

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[65] Peter of Spain is less explicit, but Braakhuis has shown that Peter employs the word *supponere* in a twofold sense: "namely of: *rei substantive representare* (80^5) and of: to stand (said of a substantive term) for something (80^{14-15})", *o.c.* note 79, 138; Petrus Hispanus Portugalensis, *Tractatus* (called afterwards *Summule Logicales*), First Critical Edition from the manuscripts with an Introduction by L.M. de Rijk Ph.D., Assen 1972; William of Sherwood, *Introductiones in logicam*, ed. Charles H. Lohr, with Peter Kunze and Bernhard Mussler, in: Traditio, XXXIX (1983), 219-99; Lamberto d'Auxerre, *Logica (Summa Lamberti)*, ed. Franco Alessio, Firenze 1971 (as tacitly corrected in Braakhuis, *o.c.*).

[66] Note Sherwood's use of language here: *natum est*, i.e. it is designed *by nature*; see below on natural supposition.

suppositio	*substantiva rei designatio vel signatio*
suppositio	*acceptio termini pro se sive pro re sua, vel pro aliquo supposito contento sub re sua vel pro aliquibus suppositis contentis sub re sua.*

The first kind of *suppositio* he calls *quaedam significatio specialis termini et non termini proprietas*, whereas the second kind is the one to be investigated by the logician.[68]

What Sherwood calls *suppositio secundum habitum*, Lambert calls *significatio termini substantivi*, and what Sherwood calls *copulatio secundum habitum*, Lambert calls *significatio termini adiectivi*. The same distinction, though less explicit, can be found in Peter of Spain. This leads to the conclusion that the thirteenth century logic of supposition draws a sharp distinction between signification and supposition as two meanings of the term supposition. One focusses upon the mode of signification with its (be it right or wrong) implication of a certain mode of being,[69] the other upon the denotation or reference of terms actually used.[70]

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[67] "Verbi gratia, significatio hominis solum extenditur ad hominem, non ad contenta sub homine: "homo" enim significat hominem, non Sortem nec Platonem. Potest tamen "homo" supponere pro Sorte et pro Platone et pro homine", *o.c.*, 206.

[68] "Dividitur autem suppositio communiter dicta in suppositionem proprie dictam et copulationem. Communiter enim loquendo supponunt termini substantivi et adiectivi; sed proprie loquendo suppositio convenit terminis substantivis, et copulatio terminis adiectivis. Et est suppositio proprie dicta acceptio termini rem fixam et per se stantem representantis secundum quam teneri potest pro re sua vel pro supposito vel suppositis contentis sub re sua."; *o.c.*, 207.

[69] Lambert says: "...si querat aliquis quare suppositio approprietur substantivis, copulatio adiectivis, ex dictis quid sit dicendum patet: supponere enim est per se stantis et rem suam fixam representantis. Per se autem stare et rem suam fixam representare proprium est substantivorum; copulare vero est adiectivis et rem dependentem representantis: adiacere vero et rem dependentem representare proprium est adiectivorum: ideo proprie loquendo suppositio est substantivorum, copulatio vero adiectivorum."; *o.c.*, 208; I cannot but read this as stating there to be a parallelism between the mode of signification and the thing to be signified, which to my mind should also be the proper interpretation of this passage from Peter of Spain: "Significationis alia est rei substantive et habet fieri per nomen substantivum, ut 'homo'; alia est rei adiective et habet fieri per nomen adiectivum vel per verbum, ut 'albus' vel 'currit'. Quare proprie non est significatio substantiva vel adiectiva, sed aliquid significatur substantive et aliquid adiective, quia adiectivatio vel substantivatio sunt modi rerum que significantur, et non significationis"; *o.c.*, *Tr.* VI,2, 79/80.

[70] Aquinas mentions neither Peter, nor William, nor his fellow-Dominican and prob-

3.3 Aquinas on supposition as a mode of signification

Aquinas is not primarily a logician, but a theologian. He neither gives an independent definition of signification,[71] nor one of supposition. What comes closest to a distinction between the two of them, is mentioned above concerning equivocation (which belongs to the level of signification) and supposition. If someone were to say that *homo* is used equivocally, Aquinas answers that equivocation (or univocation or analogous use of words for that matter) belongs to the semantic level of signification and not to the semantic level of (personal) supposition. Equivocation is caused by a diversity of signification and not by a diversity of supposition. However, this does not reveal whether the word supposition itself has two meanings in Aquinas' writings. For this, we have to look to the theory of supposition 'at work'. Aquinas' conception of the distinction is embedded in his trinitarian theology and christology.

A large number of more than 2500 instances of mentioning supposition, is devoted to indicating the supposition of *Deus*: does it stand *indistincte* for divine persons, or *distincte* for one or more of them? The logic of supposition is especially needed to provide a glimpse of understanding of the mystery of the Trinity: how can the Nicene Creed say *Deum de Deo (genitum)* and not imply that the divine essence was brought forth (*essentia genuit essentiam*) or fall back into polytheism?

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ably fellow-inhabitant of St. Jacques in Paris Lambert of Auxerre, these three being the authors of the three most famous compendiums of logic in the thirtheenth century. All of them seem to share a common tradition of 12th and 13th century logic, in stead of being dependent the one on the other (e.g. Peter on William of Sherwood).

At present only a few minor historical indications are certain:

- there is a striking resemblance between Peter's tract on fallacies and Aquinas's, that is *if* Aquinas is the author, which seems to suggest a common source (De Rijk);
- Aquinas' *De propositionibus modalibus*, that is *if* Aquinas is the author, seems to be dependent on the work of William of Sherwood (Prantl, Grabmann, Kretzmann, H.F. Dondaine);
- Aquinas uses the term *suppositio naturalis* which can be found in Peter of Spain's *Tractatus* and in the *Logica* of Lambert of Auxerre, but not in William of Sherwoods *Introductiones in logicam*; the *Summa Lamberti* however was not published before 1260, whereas Aquinas already in his commentary on Peter of Lombard's *IV Libri Sententiarum* (1254-1256) mentions the term.

[71] Cf. his commentary on *Peri Hermeneias*, first five lessons; the definition that Lambert gives comes closest to the one given by Aristotle: "Significatio termini est intellectus rei ad quem intellectum rei vox imponitur ad voluntatem instituentis", *o.c.*, p. 205.

Aquinas' first distinction is between the signification of *Deus* and its supposition. *Deus* signifies the divine essence, but it stands, in an indistinct, undetermined way, for the divine persons. Aquinas prefaces his solution with these words: *Sed in proprietatibus locutionum, non tantum attendenda est res significata, sed etiam modus significandi* (*ST* I 39.4). The mode of signification of *Deus* is concrete, i.e. it signifies the divine nature as possessed by an individual, just like *homo* signifies a *person* of human nature. In general the proper supposition of *Deus* is a standing for an individual of divine nature, a property the term owes to its concrete mode of signification.

Aquinas' partners in discussion subscribe to the opinion that only the context of a predicate which belongs to one or more persons, a 'notional' predicate, makes *Deus* to stand for a person. By its nature (*proprie secundum suam naturam*) it stands for the divine essence. Both in *Scriptum* and *Summa Theologiae*, Aquinas mentions this position, and both times he respectfully yet firmly rejects it.[72] Divine simplicity means that God's essence and God's subsistence are one, unlike anything else we know of. But human modes of signification are fit to talk about what we know of, i.e. created things. That means that divine simplicity cannot be the reason for bypassing the property that the term *Deus* as a concrete noun in our language has.[73] A concrete noun normally stands for an individuated nature and not for a nature or essence as such. Theology apparently should speak as logically as possible, with the accent on both 'logical' and 'as possible'. Logic demands that a certain kind of supposition follows upon a certain mode of signification, while the limitations of our speech demand that we leave room for the unique and unknown God, in whom essence and supposit are identical.

We may conclude that while Aquinas distinguishes signification and supposition of words,[74] he must also show how this distinction often fails to obtain *in divinis*. Yet a theologian must respect it, lest theological howlers occur. This is made quite obvious in the twin-question of the one that we have just discussed (*Deus genuit Deum*?): *Essentia genuit Essentiam*? The term *essentia* in this proposition is a shorthand term for all those nouns that have the abstract mode of signification and express some aspect of God that is of God's essence, and not distinctly of a divine person. The rejected reasoning is simple: if there is an identity of essence and supposit in God, then the terms expressing each are interchangeable as well. The interpretation of *Essentia genuit Essentiam* would then be: *Pater genuit Filium*. Aquinas rejects this view, since *essentia* does not have the mode of signification which would make the predication of personal properties possible.

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[72] "Et haec opinio videtur verior esse", 1*SN* 4.1.2; "alii melius dixerunt", *ST* I 39.4.

[73] "Et haec opinio processisse videtur ex consideratione divinae simplicitatis, quae requirit quod in Deo idem sit habens et quod habetur: et sic 'habens deitatem', quod significat hoc nomen 'Deus', est idem quod 'deitas'. Sed in proprietatibus locutionum, non tantum attendenda est res significata; sed etiam modus significandi. Et ideo, quia hoc nomen 'Deus' significat divinam essentiam ut in habente ipsam, sicut hoc nomen 'homo' humanitatem significat in supposito; alii melius dixerunt quod hoc nomen 'Deus' ex modo significandi habet ut proprie possit supponere pro persona, sicut et hoc nomen 'homo'", *ST* I 39.4.

[74] Other texts where the distinction between supposition and signification is made:

The same kind of argument can be found in Aquinas' christology. 'Given that the Son of God has suffered, and Son and divine nature are identical, divine nature can be said to have suffered', is unacceptable since it doesn't respect the different modes of signification of *Filius* and *Divina natura*.[75]

We wanted to know whether Aquinas uses *supponere* in a twofold sense. The first part of the answer can now be given: Aquinas uses *sup-*

1*SN* 4.1.2 *sol* + ad 2; 5 *expositio textus*; 32.2.2.1 ad 1; 3*SN* 6.1.3; 7.1.1 ad 2,4,5; *QDP* 8.4 ad 6; *ST* I 39.4 ad 1; III 3.6 ad 3; III 16.1; III 16.9 ad 3; *REP* I 1 [134]; *OTT* I 211 [141]; cf. 1*SN* 9.1.1 ad 2.

This corresponds with another distinction: predicates are taken *formaliter* and subject-terms *materialiter*: 1*SN* 21.1.1.2; 21.2.1 *obiectum* 4; 3*SN* 1.2.5 ad 5; 5 *expositio textus*; 6.1.3 ad 3; 6.2.1 ad 7; 11.2 ad 3; 22.1.2; *ST* I 13.12; I 31.3 ad 2; III 16.7 ad 4 ("terminus in subiecto positus tenetur materialiter, idest pro supposito; positus vero in praedicato, tenetur formaliter, idest pro natura significata"); III 16.9; III 16.10; III 17.1 ad 3; cf. 1*SN* 21.2.1 ad 1; *ST* I 3.3; *QDP* 9.4; *CMP* IX 11.4 (1898); *REI* I 1 [868].

Apart from these, there are many texts in which Aquinas discerns truth-conditions of propositions, where *ratione significati* is distinguished from *ratione suppositi* or *ratione identitatis*; e.g. 1*SN* 23 *expositio textus*; 3*SN* 7.1.1 ad 5; 7.2.1 ad 4; 12.1.1; *ST* I 39.4 *obiectum* 2; *REP* I 1 [135].

The whole logic of reduplicative statements ("Christus secundum quod x est y") depends on this distinction: 3*SN* 10.1.1.1 *corpus* + ad 2 + 3; 10.1.1.2 *sed contra* 1 + *sol*; *ST* III 16.10 *corpus* + ad 2; III 16.11; III 16.12.

[75] Aquinas expresses the verdict on this kind of argumentation with the denial of the rule: each predicate which truly is said of a subject can stand for the subject ("omne quod vere praedicatur de aliquo potest supponere pro ipso"). This rule does not apply, since the predication of an essence of one of the divine persons, is not a normal predication in accordance with the common modes of signification: "supposito uno, non supponitur aliud"; 1*SN* 4.2.2 ad 5; 5.1.1 *obiectum* 2; 26.1.1 ad 5; 3*SN* 6 *prologus* [157]; *ScG* IV 38.8; *ST* I 39.1 ad 2; I 39.5 ad 4; *QDI* 1 ad 12; cf. also the reverse: *ST* III 16.1; *OTT* I 211 [144].

ponere in the sense of mode of signification. There is one major difference with the logicians that we have discussed. Aquinas links supposition not so much with substantive terms, as opposed to copulation and adjective terms, but with concrete terms, as opposed to abstract ones. Aquinas is familiar with the distinction between supposition and copulation, a theory that he attributes to the *sophistae*,[76] but from the frequency that he mentions the distinction between abstract and concrete signification in connection with supposition we may gather that he deems this distinction more suitable for his purposes.

3.4 Aquinas on supposition as denotation

Terminist logicians such as Peter of Spain, William of Sherwood and Lambert of Auxerre treat modes of supposition as modes of denotation i.e. a term is interpreted to stand either for itself, or for the concept/nature it signifies, or for individual(s) that participate in the nature signified. The latter two even explicitly say so, as we have seen. Their treatment of supposition consists of the construction of a 'tree', in which pairs of modes are ordered hierarchically.

Aquinas is well acquainted with the technical names for each of the modes, used in the *logica modernorum*, even though we can only find a few texts in which he employs these terms explicitly. On the basis of his usage of these terms, however, we are able to reconstruct a scheme of varieties of supposition which is quite similar to a scheme of medieval logic in general, reconstructed by Spade on the basis of manuals of logic.[77]

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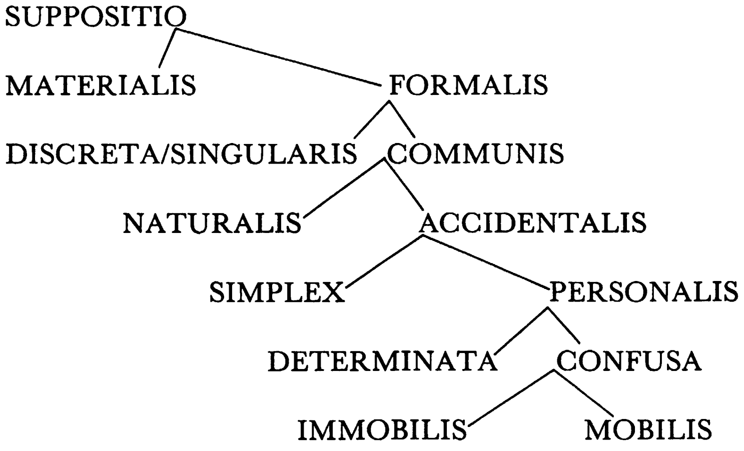
[76] On the distinction between *suppositio* and *copulatio* see 3*SN* 6 *prologus* [229]; 7.1.1 ad 5; 7.2.2; 12.1.1; *ST* I 39.5 ad 5; and especially *QDP* 9.4.

Aquinas mentions the *sophistae* four times: "...sicut dicunt sophistae dictio exclusiva immobilitat terminum cui adiungitur ratione negationis implicitae." (1*SN* 21.1.1 ad 2); "...quia, ut sophistae dicunt, dictio exclusiva immobilitat terminum cui adiungitur, ut non possit fieri sub eo descensus pro aliquo suppositorum." (*ST* I 31.3 ad 3); "...quia, ut sophistae dicunt, terminus singularis idem significat et supponit" (*ST* I 39.4 *obiectum* 1); "...unde sophistae dicunt quod nomina substantiva supponunt, adiectiva vero non supponunt, sed copulant." (*ST* I 39.5 ad 5). So it seems that Aquinas intends the terminist logicians when he says *sophistae*.

[77] Paul Vincent Spade, *The semantics of terms*", in: *Cambridge History of Later Medieval Philosophy*, 188-96; The distinction *confusa tantum/distributiva*, given by Spade as a subdivision of *confusa*, I have left out. The term *confusa tantum* Aquinas does not use, and *distributive* is mentioned in six texts albeit only in a general sense (*ST* I 31.4 ad 2; 2*SN* 40.1.5 ad 7), or as a characterization of *syncategoremata* (*omnis, ubique, semper*; 3*SN* 5 *expositio textus*; *CMP* V 21.24 (1108); 1*SN* 37.2.3 ad 2). I have found one other attempt to reproduce Aquinas' usage of the logic of supposition, Enders, *o.c.*, 79. However,

The varieties of supposition that Aquinas uses in his theology, can be taken together in this scheme:



Examples from the texts of Aquinas elucidate this scheme:

suppositio materialis:	*curro est verbum*[78]
suppositio discreta:	*Pater et Filius sunt unus Deus*[79]

Enders forms two trees, and only on the basis of the research of Manthey and Bochenski. Enders needs two trees, since he thinks that Aquinas uses the terms 'formal' and 'material' in opposed ways, formal supposition indicating sometimes *suppositio simplex* and sometimes *suppositio personalis*. However, in those texts, and they are many, in which the first meaning is used, Aquinas does not talk about *suppositio formalis*, but about *teneri formaliter*, which indicates signification rather than supposition. Enders omits the distinction between *discreta/singularis-communis* and *immobilis/mobilis*, and he reverses *naturalis/accidentalis*.

[78] *CPE* I 5.6; other examples are:
- scio istum currere 1*SN* 38.1.5 ad 4
- dico Socratem currere (ibidem)
- dico solem moveri (ibidem)
- hoc est corpus meum 1*Cor* 11.55 and *Mt* 26.26 - *ST* III 78.5; *R1C* XI 5 [402]; *REM* XXVI 3 [298];
- detrahe spolia, praedare *Isaiah* 8.1 - *CIS* VIII 1 [48]
- non scio eum *John* 8.55 - *REI* VIII 8 [355]
- Socratem currere 1*SN* 41.1.5

Aquinas does not mention the term *suppositio materialis/formalis*, but uses the phrase *sumere materialiter/formaliter*: the distinction between a term standing for itself and a term having supposition on the basis of its signification.

[79] Compare *ST* I 39.3 with I 39.4 *obiectum* 1 and its answer, and 1*SN* 4.1.2 ad 3 where Aquinas uses this example. The term *Deus* is both a common or universal and a singular term. Due to it being a singular term it is not used in plural in the example given. On the distinction between *terminus communis* and *terminus singularis/discreta,* see further 1*SN* 21.2.1 ad 4; 3*SN* 1.2.4 ad 6; cf. *ST* I 13.9; *DP*3 10 [91]. Cf. the supposi-

suppositio naturalis: *Deus est Pater et Filius et Spiritus Sanctus*[80]
suppositio simplex: *Deus creat*[81]
suppositio determinata: *Solus Deus generat*[82]
immobiliter: *Solus Deus creat.*[83]

I think it is justified to take natural supposition to be a part of this scheme of varieties of *actual* supposition: the denotation of words used in a certain context. The instances in which Aquinas uses this concept show that it is not merely virtual or potential supposition, on the basis

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tion of *Christus*, e.g. 3*SN* 11.2 *sed contra* 1; 4*SN* 15.4.6.2 ad 1 and of *iste homo*, e.g. *ST* III 16.10-12. From this we gather that other examples might be:
- Iste homo est Deus;
- Christus est Deus.

[80] 3*SN* 1.2.4 ad 6; other examples are:
- iste solus homo est Pater et Filius et Spiritus Sanctus (ibidem)
- "Regi saeculorum, immortali, invisibilii, soli Deo" etc. (1*Timothy* 1.17 - *ST* I 39.4)
- "Unus solus verus Deus" (Augustine - 3*SN* 1.2.4 ad 6)
- Hic est Deus, et non aestimabitur alius ab illo" (*Baruch* 3.36 - ibidem)

Cf. also *ST* I 39.5; III 4.3; III 17.1; III 16.1; *REI* I 1 [550]; these are all texts where *naturaliter* is used in connection with supposition; as will be shown below, not all of these texts however concern natural supposition in the sense of to stand for all things that participate in the nature signified by the term, whether past, present or future; the first text mentioned is the only text in which *suppositio accidentalis* is used.

[81] *ST* I 39.4; another example is the unusual interpretation of
- Homo factus est Deus (*ST* III 16.7), and
- Homo est species (*ST* I 39.4 ad 3; *DP3* 10 [91])

On the distinction between *suppositio personalis* and *suppositio simplex* see the texts mentioned, and *ST* I 39.6 ad 1 as well.

[82] *ST* I 39.4 ad 3; another example gives us the exact difference:
- Pater et Filius sunt unum principium, ergo aut unum principium quod est Pater, aut unum principium quod non est Pater.

The first time *principium* has confused supposition, but the second and third time determinate supposition. Therefore the argument is fallacious (*ST* I 36.4 ad 4, cf. ad 5 and 6). This distinction between *determinata* and *confusa* very much resembles the distinction between *distincte* and *indistincte*, adduced in trinitarian contexts discussing the supposition of *Deus*: 1*SN* 4.1.2 *sol* and ad 1 + 2; 4.2.2 ad 4 + 5; 5.1.2 *sol* + ad 1; 21.2.2 ad 3; 24.2.2 ad 2; 29.1.4 ad 2; 3*SN* 1.2.4 ad 6; *ST* I 39.4 ad 3; III 17.1 *corpus* and ad 4; *OCE* I 4 [63].

Sometimes the word *confuse* indicates the absence of the influence of a consignified time upon the actual supposition which results in supposition for things past, present and future: 1*SN* 43 *expositio textus*, *ST* I 25.5 ad 2 (both: Deus non potest facere nisi quod iustum est); cf. also 3*SN* 3 *expositio primae partis textus*; *REM* XXIV 3 [40]; *REI* XVI 6 [52].

[83] *ST* I 31.3 ad 3; 1*SN* 21.1.1 ad 2; another example:
- Solus homo est animal rationale mortale (ibidem).

Propositions with immobile supposition do not admit of any descent to singulars, like "Only the Holy Spirit creates" or "Only Socrates is a rational mortal animal"; Aquinas doesn't give examples of mobile supposition (Spade, *o.c.*, 196: "Every man is an animal").

of the substantive mode of signification a word has, abstracted from the context of the proposition in which it is used.[84] *Deus* in *Deus est Pater et Filius et Spiritus Sanctus* actually stands for all the ''individuals'' that ''participate'' in the divine nature signified by the word.

This all shows that Aquinas is well-versed in the logic of supposition and that he employs it throughout his theology. More than merely one of his logical instruments, it is an essential instrument. This may be illustrated from his christology.

The mystery of the Incarnation revolves around the nature of the union of God and man. How is it possible that Christ is truly God and truly man? Faced with three ways of accounting for the hypostatic union, Aquinas adheres to the second opinion which Peter of Lombard discusses,[85] yet which Aquinas avers to be the truth: the same *suppositum*, the same person 'has' both natures. Aquinas is well aware of the fact that the divine nature is not literally *had* by the Son of God. He also states clearly that *suppositum*, literally meaning some sort of subordination, does not apply literally to God.[86] So his rational account has its limits too. The other two opinions, however, are clearly false: one posits only an habitual union of both natures which would endanger human salvation, while the other holds that there is one person but two *supposita*, which is unthinkable. If there is one person in Christ, there must be one and only one *suppositum* as well.

What is interesting here is that both opinions that Aquinas rejects, can be and are formulated in terms taken from the theory of supposition. Those who defend the theory of an habitual union, accept a signification of the term *homo* which is only aequivocal, since they deny, for fear of teaching some sort of adoption of a man and thus endangering Christ's unity, that body and soul are mutually united. Moreover, they think that the term *Deus* when used in the proposition *Deus est homo* only copulates, and does not have supposition, just like *Hoc album est homo*.[87] This expresses in logical categories, what in metaphysical categories may be called a denial of the presence of a substantial human nature in the Son of God Incarnate.

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[84] This is the interpretation that De Rijk in 1971 put forward, following Boehner and to a certain extent Moody. A rewritten version of this article appeared in his book *Middeleeuwse Wijsbegeerte*, in which he altered his interpretation of this variety that can be encountered in Peter of Spain and Lambert of Auxerre and made a choice for natural supposition indeed as a variety of actual supposition. See below.

[85] *IV Libri Sententiarium*, III, *distinctio* 6.

[86] 1*SN* 34.1.1 ad 3; cf. 3*SN* 5.2.1 ad 3 + 4; *ST* I 39.1 ad 3.

[87] 3*SN* 7.1.1 ad 5; this would also run counter to the accepted teaching that only adjectives copulate, not substantives.

The other opinion says that there is only one person in Christ, but two supposits. Thus the so-called *Assumptus-Homo* theory verifies the proposition *Deus est homo* as: the one who is God is the same as the one who is man. Aquinas however thinks that the proper interpretation should be: the one who is God subsists essentially in a human nature. The predication of *homo* is not *per identitatem* but *per informationem essentialem.*[88]

Moreover, only the *suppositum* receives the predication of operations and natural properties, and if there were a *suppositum* in Christ other than the eternal one, we would no longer be able to read Holy Scripture, and predicate divine actions and properties of *(Christus) homo*, nor human actions and properties of *(Christus) Deus*. In fact, we could no longer uphold Christ's unity.[89]

We wanted to know whether Aquinas uses *supponere* in a twofold sense. The first part of the answer has been given: Aquinas uses *supponere* in the sense of mode of signification. The second part may be concluded from his usage of the technical terms involved in the distinction of varieties of actual supposition: Aquinas also uses *supponere* in the sense of a property of a (concrete) word to stand for or denote either itself, its conceptual content, or individual(s) that participate in the nature signified. *Supponere* in Aquinas means both a certain mode of signification and actual denotation.

4. Supposition and modes of signification: natural supposition

4.1 A twofold meaning of 'natural'

Let me call to mind once again this peculiar statement of William of Sherwood: *Et notandum, quod suppositio et copulatio dicuntur multipliciter,*

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[88] 3*SN* 7.1.1; cf. the textual variant given in the Moos-edition, 262, and ad 5: "et hoc est singulare in materia ista, quia nunquam alibi invenitur quod sit suppositum unum essentialiter in duabus naturis subsistens". The theory of supposition provides christology with an accepted means of verification but not with a model to comprehend what is said.

[89] *ST* III 2.3; cf. the demand of Cyril, bishop of Alexandria, quoted by Aquinas: "Si quis personis duabus vel subsistentiis, eas quae sunt in Evangelicis et Apostolicis Scripturis impartitur voces, aut de Christo a Sanctis dictas aut ab ipso de se, et quasdam quidem velut homini, praeter illud ex Deo Verbum specialiter intellecto applicat, quasdam vero velut Deo dicibiles, soli ex Deo Patre Verbo: anathema sit"; cf. *ST* III 16.4 and *ScG* IV 38.8.

sicut multa huiusmodi nomina, aut secundum actum aut secundum habitum (*o.c.*, 5.0.1). William gives a feature typical for words like supposition and copulation, so he says. I think this statement of William's is highly significant. He draws attention to the fact that whenever one uses language to discern semantic laws that are at work in actual use of language in order to be able to distinguish different meanings of the same words in different propositions, one is likely to add one more level of meaning to language itself. On this level one has to be extremely careful not to make the very mistake the avoidance of which is the primary goal of designing this second order language.

Take a proposition like *Deus est incarnatus*. A theologian with logical skills might remark: *Deus potest supponere*. What does the theologian say? Does he indicate the fact that *Deus*, unlike *Divina Essentia*, has a concrete mode of signification and therefore may denote a divine person? Does he indicate that *Deus* can have personal supposition for the Son of God, but that the word can also have *suppositio simplex*, i.e. for divine nature as such, since *Divina natura est incarnata* is also true? Or does he indicate the fact that if *Deus* supposits for the Son of God, the proposition is true? All three meanings are possible. The phrase *potest supponere* turns out to have at least three different meanings: it may indicate a difference between modes of signification, it may indicate the difference between modes of supposition, and it may indicate that for some individuals the proposition is true whereas for others it is not.[90] Only the first two of these meanings appear on a level different from the level of *Deus est incarnatus*, since the meaning of the third possible interpretation can easily be expressed by giving an alternative expression like *Filius Dei est incarnatus*. So we are left with either the difference between modes of signification or the difference between modes of supposition. This is exactly what William in those few words wanted to emphasize, and we are able to show that Aquinas had in mind something similar. It is hidden in Aquinas' twofold use of the word *naturaliter* in connection with *supponere*.

The literal term *suppositio naturalis* Aquinas uses only twice throughout his work: the noun *Deus* (...) *habet naturalem suppositionem pro persona*[91]. The context is the question concerning the truth of the proposition *Deus genuit Deum*, as opposed to *Essentia genuit Essentiam*. The natural supposition of *Deus* is an aptitude which results from the concrete mode of signification of that term:

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[90] Put differently:
a) potest ⇔ non potest
b) potest habere suppositio x ⇔ potest habere suppositio y
c) potest supponere pro x ⇔ potest supponere pro y.

[91] *ST* I 39.4 ad 2; cf. 3*SN* 1.2.4 ad 6.

> Nam hoc nomen 'Deus', quia significat divinam essentiam ut in habente, ex modo suae significationis naturaliter habet quod possit supponere pro persona (*ST* I 39.5).

In fact there are very few texts in which 'natural' is connected with supposition, but relatively quite many with the term *potest.*[92] It is not mere coincidence that in similar cases, i.e. the supposition of *Deus* or *Principium*, Aquinas seems to address the possible or potential supposition of the term. Natural supposition concerns the ability of a concrete substantive term to refer to an individual. When *Deus* is said to have natural supposition, it is meant that the concreteness of the noun makes it apt for a certain actual use. *Deus*, unlike *Divina Essentia*, has this aptitude, but the actual use of the term, its propositional context, will tell us what kind, what variety of supposition it has, for example *suppositio naturalis* or *suppositio accidentalis*:

> Sicut iste terminus 'Deus' supponit in praedictis locutionibus (e.g. *"unus solus verus Deus"* - Augustine) rem naturae divinae indistincte. Et haec est suppositio sua naturalis, et quasi termini communis respectu trium personarum. Suppositio autem qua supponit pro Patre vel Filio, est sibi accidentalis et quasi termini discreti (3*SN* 1.2.4 ad 6).

A concrete noun signifying God as a common term, needs some sort of addition in order to stand for a distinct person.[93] Its natural supposition is to stand for all persons indistinctly.

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[92] 1*SN* 4.1.2 *sol* + ad 2; 5.1.1 *obiectum* 2 + ad 4; 3*SN* 1.2.4 *obiectum* 6; 4.1.2.1; *ST* I 39.4 *obiectum* 2 + *corpus*; I 39.5 *videtur*... + *obiectum* 4 + *corpus* + ad 4; III 16.1; III 16.2; III 35.4; *QDV* 7.2 ad 1; *QDI* 1 ad 12; *OCE* I 4 [63]; *REI* I 1 [550]; *DP*3 8 [49, 51, 64, 70].

[93] "Ex adiuncto determinatur eius suppositio ad personam", *ST* I 39.4 ad 3. This reverses to a certain extent the logic of created things: *homo* needs an addition in order to stand for human nature as such ("homo est species"), but "Deus per se supponit pro natura communi" (*ST* I 39.4 ad 3). In our daily speech, personal supposition, whether it be for one or more distinct individuals, or left indeterminate, is the normal variety of supposition. *Suppositio simplex*, where the term having this supposition stands for the nature, the quality signified by the term, is rare. Yet since God's nature subsists, this is the *per se* (not to be confused with 'natural') supposition of *Deus*. Aquinas in fact distinguishes the *per se* supposition of *Deus*, looking upon the signified form of the name, from the supposition *proprie* or *naturaliter* of *Deus*, looking upon its mode of signification. In itself, this distinction, once again, is a concession to our mode of signification, because our nouns "significant substantiam cum qualitate".

So we are faced with a twofold use of *naturaliter*: one indicating the mode of signification which makes a term apt for (personal) supposition (in stead of copulation or instead of signifying abstractly), and one indicating a certain type of actual supposition (in stead of accidental supposition in which the range of reference of the term is restricted because of the words added).[94] The term natural supposition either distinguishes modes of signification, or modes of supposition.

4.2 The interests of theology

Aquinas has written only one or two texts in which he uses natural supposition to distinguish modes of supposition. He shows that the fact that *Deus* sometimes supposits for all three divine persons indistinctly and sometimes for one or two persons distinctly, concords with accepted logic. More important for his purposes however is the use of 'natural supposition' to distinguish modes of signification. It enables theology to explain why properties belonging to only one or two persons can be predicated of *Deus* but not of *Essentia*, even though *secundum rem* God is identical to his essence:

> Ad veritatem locutionum, non solum oportet considerare res significatas, sed etiam modum significandi, ut dictum est. Licet autem, secundum rem, sit idem 'Deus' quod 'deitas', non tamen est idem modus significandi utrobique. Nam hoc nomen 'Deus', quia significat divinam essentiam ut in habente, ex modo

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[94] The recent history of interpretation of natural supposition shows how all interpreters feel forced to make a choice between on the one hand 'natural' indicating the mode of signification of the term, and on the other hand indicating the broadest range of reference of a word, including things past, present and future. De Rijk exemplifies this in changing his opinion from the first to the second alternative: *The Development of "Suppositio naturalis" in Mediaeval Logic*, in: Vivarium, IX (1971), 71-107; XI (1973), 43-79; De Rijk, *Middeleeuwse Wijsbegeerte. Traditie en vernieuwing*, Assen/Amsterdam 1977; (Chapter 8: "Natuurlijke suppositie: Een toetssteen voor wijsgerige standpunten", 233-57). His most recent publication, *The origins of the theory of the properties of terms*, in: *Cambridge History of Later Medieval Philosophy*, 161-73, is unclear in this respect, but seems to avoid any choice. For different interpretations cf. J.M. Mullally, *The "Summulae Logicales" of Peter of Spain*, Notre Dame 1945; introduction, xxxviii - lviii; Boehner, *o.c.*, 27-36; Moody, *o.c.*, 21-2; De Rijk, *Logica Modernorum* II,1, 571-8.

The second alternative is tied up with the logical problems whether a word can signify anything that is univocally common to being and non being, and whether a word can loose its significance (cf. Braakhuis *o.c.* on Roger Bacon and William of Sherwood; cf. Peter Raedts, *Richard Rufus of Cornwall and the Tradition of Oxford Theology*, Oxford 1987, 32ff). Aquinas however was not engaged in this problem, as his treatment of the question *Utrum Christus in triduo mortis fuit homo* shows (3*SN* 22.1.1; *ST* III 50.4; *QDL* 2.1.1; *QDL* 3.2.2).

> suae significationis naturaliter habet quod possit supponere pro persona: et sic ea quae sunt propria personarum, possunt praedicari de hoc nomine 'Deus', ut dicatur quod 'Deus est genitus' vel 'generans', sicut dictum est. Sed hoc nomen 'essentia' non habet ex modo suae significationis quod supponat pro persona: quia significat essentiam ut formam abstractam. Et ideo ea quae sunt propria personarum, quibus ab invicem distinguuntur, non possunt essentiae attribui: significaretur enim quod esset distinctio in essentia divina, sicut est distinctio in suppositis (*ST* I 39.5).

The question that precedes this determination is even more explicit on the subject, and adds another mode of supposition, i.e. one that denies the concrete mode of signification of *Deus*:

> Respondeo dicendum quod quidam dixerunt quod hoc nomen 'Deus' et similia, proprie secundum suam naturam supponunt pro essentia: sed ex adiuncto notionali trahuntur ad supponendum pro persona. Et haec opinio processisse videtur ex consideratione divinae simplicitatis, quae requirit quod in Deo idem sit habens et quod habetur: et sic 'habens deitatem', quod significat hoc nomen 'Deus', est idem quod 'deitas'.
>
> Sed in proprietatibus locutionum, non tantum attendenda est res significata, sed etiam modus significandi. Et ideo, quia hoc nomen 'Deus' significat divinam essentiam ut in habente ipsam, sicut hoc nomen 'homo' humanitatem significat in supposito, alii melius dixerunt quod hoc nomen 'Deus' ex modo significandi habet ut proprie possit supponere pro persona, sicut et hoc nomen 'homo'.
>
> Quandoque ergo hoc nomen Deus supponit pro essentia, ut cum dicitur 'Deus creat': quia hoc praedicatum competit subiecto ratione formae significatae, quae est deitas. Quandoque vero supponit personam: vel unam tantum, ut cum dicitur 'Deus generat'; vel duas, ut cum dicitur 'Deus spirat'; vel tres, ut cum dicitur 'Regi saeculorum, immortali, invisibili, soli Deo' etc. (I *Tim* 1,17) (*ST* I 39.4).[95]

Aquinas uses here the phrase *supponit pro essentia* as well, but since of all essences or natures only God's essence subsists this is a unique category. Only in the case of God does a common nature subsist. This kind of supposition, which resembles *suppositio simplex*, is not caused by the mode of signification of *Deus,* but is a consequence of the doctrine of divine simplicity:

> Et ideo de se habet quod possit supponere pro persona, et non habet quod supponat pro essentia ex modo significandi nominis, sed tantum ex ratione divinae simplicitatis, in qua idem est re essentia et suppositum. *Cf. ad 1:* hoc nomen Deus importet suppositum indistinctum, quod non distinguitur nisi personali proprietate adjuncta, ut paternitate vel filiatione. *Cf. ad 2:* quamvis hoc nomen Deus significet essentiam, tamen, quantum est de se, supponit habentem essen-

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[95] Confusing as it may be, *supponere secundum suam naturam* is not an instance of natural supposition, in either way, as I interpret Aquinas. Instead, Aquinas distinguishes between the nature signified (*secundum suam naturam - significatam*) and the mode of signification (*ex modo significandi*). The concrete mode of signification entails a natural, i.e. according not to the nature signified but to the nature of the word used, ability to stand for (a) concrete person(s).

> tiam, et rem naturae, etiam non intellectis personis, quas fides distinguit. Unde potest supponere pro persona, etiamsi ab alio non restringatur. Et quia supponit personam indistincte, ideo potest stare in locutione pro quacumque persona: et sic reddit locutionem veram. Unde in hac propositione 'Deus generat Deum', in supposito stat pro Patre, in apposito pro Filio (1*SN* 4.1.2.c).[96]

Following the concrete mode of signification, *Deus* normally, naturally has supposition for the divine persons indistinctly. The actual supposition is determined by the context, as Aquinas' explanation of the Johannine *Verbum erat apud Deum*[97] demonstrates:

> Sciendum est ergo in primis quod hoc nomen 'Deus' significat divinitatem, sed in supposito et concrete; hoc vero nomen 'Deitas' significat deitatem in abstracto, et absolute: et inde est quod non potest supponere pro persona ex naturali virtute et ex modo significandi; sed supponit solummodo pro natura. Hoc vero nomen 'Deus' habet naturaliter ex modo significandi quod supponat pro aliqua personarum, sicut hoc nomen 'homo' supponit pro supposito humanitatis, et ideo quandocumque veritas locutionis, vel ipsum praedicatum exigit ut hoc nomen Deus supponat pro persona, tunc supponit pro persona ut cum dicimus, 'Deus generat Deum'. Et ita cum hic dicitur 'apud Deum', necesse est quod 'Deus' pro persona patris supponat, quia haec praepositio 'apud' distinctionem significat Verbi, quod esse dicitur 'apud Deum'. Et licet significet distinctionem in persona, non tamen in natura, cum eadem sit natura patris et filii. Evangelista igitur significare voluit patris personam per hoc quod dixit 'Deum' (*REI* I 1).

To put it sharply: the word *Deus*, because of its mode of signification, has natural supposition, and therefore, in *Verbum erat apud Deum* it does not have natural supposition, but accidental supposition, standing for the Father. The first 'natural' indicates the mode of signification, the second the mode of supposition.

The distinction between modes of signification, one resulting in natural supposition and the other not, not only helps a theologian to speak with logical accuracy in matters regarding the Holy Trinity, but also in matters regarding the hypostatic union in Christ.

Regarding Christ, the main distinction is not the one between modes of supposition, but between modes of signification.[98] The truth of Christ being truly God and truly man can only be expressed when due consideration is given to concrete and abstract modes of signification. In *Deus est homo*, not only the signification of *Deus* and *homo* needs to be true, but the predication as well:

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[96] Sometimes the phrase *supponere pro essentia* seems to be interchangeable with *supponere indistincte pro persona*: "Similiter cum dicitur: Deus est trinus, significatur quod est habens tres personas in una essentia, unde ly "Deus" supponit tunc vel essentiam vel suppositum indistinctum" (1*SN* 24.2.2 ad 2).

[97] This is one of the two texts contained in Aquinas' commentaries on Holy Scripture that are very important for his conception of supposition. The other one is his commentary on this passage from the letter to the Romans: "De Filio Suo, qui factus est ei ex semine David secundum carnem, Qui praedestinatus est filius Dei..."; *CRO* I 2 + 3.

[98] The distinction between concrete and abstract modes of signification is omnipresent in Aquinas' christology. Concrete signification is also called (in *ST* III):

> Nomen enim significans naturam communem in concreto potest supponere pro quolibet contentorum in natura communi: sicut hoc nomen 'homo' potest supponere pro quolibet homine singulari. Et ita hoc nomen 'Deus', ex ipso modo suae significationis potest supponere pro persona Filii Dei, ut in Prima Parte habitum est (39.4). De quolibet autem supposito alicuius naturae potest vere et proprie praedicari nomen significans illam naturam in concreto: sicut de Socrate et Platone proprie et vere praedicatur 'homo'. Quia ergo persona Filii Dei, pro qua supponit hoc nomen 'Deus', est suppositum naturae humanae, vere et proprie hoc nomen 'homo' potest praedicari de hoc nomine 'Deus', secundum quod supponit pro persona Filii Dei (*ST* III 16.1).

The proposition is not only figuratively speaking true, as when we say, because of some connection between the two, 'Peter is John', but properly. We do not predicate human nature of divine nature, nor divine nature of human nature, and thus teach something impossible and blasphemous i.e. a mixing of divine with human nature.

Attention to modes of signification is essential for the core doctrine of 'communication of idioms', i.e. the predication of both divine and human properties of the same person:

> Omne nomen significans in concreto naturam aliquam, potest supponere pro qualibet hypostasi illius naturae. Cum autem unio incarnationis sit facta in hypostasi, sicut supra dictum est, manifestum est quod hoc nomen Deus potest supponere pro hypostasi habente humanam naturam et divinam. Et ideo quidquid convenit divinae naturae vel humanae, potest attribui illi personae: sive secundum quod pro ea supponit nomen significans divinam naturam; sive secundum quod pro ea supponit nomen significans humanam naturam (*ST* III 35.4).[99]

The theologian puts the natural ability of concrete words to his own use.[100] The concept of natural supposition, understood as a distinction

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"significare ut totum, significare habens naturam, significare in supposito, significare per modum subsistentis, significare prout est in aliquo supposito, significare prout est in singularibus, significare quiddam per se subsistens".

[99] Cf. *ST* III 3.7 ad 3.

[100] Aquinas sometimes uses *nata est* in stead of *naturaliter*:

- "Hoc autem nomen 'homo' significat humanam naturam prout est nata in supposito esse: quia, ut dicit Damascenus, sicut hoc nomen 'Deus' significat 'eum qui habet divinam naturam', ita hoc nomen 'homo' significat 'eum qui habet humanam naturam'. Et ideo non est proprie dictum quod Filius Dei assumpsit hominem, supponendo, sicut rei veritas se habet, quod in Christo sit unum suppositum et una hypostasis". (*ST* III 4.3)
- "Sed humana natura non potest praedicari de Christo secundum se in abstracto, sed solum in concreto, prout scilicet significatur in supposito. Non enim vere potest

between modes of signification, serves a typical theological interest. It enables a theologian to interpret passages from Scripture and fathers properly. It enables him to justify the unity of Christ and the doctrine of the communication of idioms. It enables him to attribute distinct personal properties to God, without thereby implying a divided divine essence. Of course, there may be other logical devices to do the same job. Natural supposition may not be absolutely necessary to theology, but Aquinas' semantic analyses show that he has found this device extremely useful. The way he uses it, it doesn't blur the distinction between signification and supposition at all, because it expresses that very distinction: some words can and others cannot fulfill the logical function of personal supposition.

Conclusion

Aquinas' use of the logical doctrine of supposition shows how far thirteenth century theology goes in trying to give a proper interpretation of texts, and to build proper arguments accounting for the principal mysteries of Christian faith. It shows the possibilities of this logic, but its limitations as well.

Possibilities are offered inasmuch as an increasing awareness of the modes of signification of words and their influence upon the actual supposition of words in use, promotes clear and true language *in divinis*. The distinction between signification and supposition reflects the metaphysical distinction between essence and supposit. The word *supponere pro* has the double meaning of signification and supposition, but does not promote a blurring of both distinct semantic properties, just like the metaphysical categories are not improperly mixed, and just like the concept of natural supposition has the same double meaning without resulting in confusion. The double meaning expresses the fact that only concrete words can have personal supposition.

Aquinas' use of the doctrine of supposition bears a close

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dici quod 'Christus sit humana natura', quia 'natura humana' non est nata praedicari de suo supposito..." (*ST* III 17.1).

This is quite important to note, since William of Sherwood, who does not talk of natural supposition but of habitual supposition, uses *est nata* as well: "Secundum autem quod sunt in habitu, dicitur suppositio significatio alicuius ut subsistentis. Quod enim tale est, natum est ordinari sub alio. Et dicitur copulatio significatio alicuius ut adiacentis. Quod enim tale est, natum est ordinari supra aliud."(*o.c.*, 5.0.1).

resemblance to the ones expounded by William of Sherwood, Peter of Spain and Lambert of Auxerre, but it is not identical to any one of these. Most technical terms for modes of actual supposition can be encountered in Aquinas' writings. But 'natural supposition' is not only, as it is in Peter of Spain and Lambert of Auxerre, a mode of actual supposition, but, in a way which resembles Sherwoods habitual supposition, a distinction based on modes of signification as well. Moreover, Aquinas adds to all three of them his interest in the mode of signification of concrete and abstract words, instead of only the mode of signification of substantives and adjectives. Moreover, the trinitarian context does not provide Aquinas with the need to go into detail into natural supposition for things past, present and future: God is eternal.

In several instances Aquinas emphasizes the necessity to speak properly according to the modes of signification. He is prompted to do so, since some theologians take the ultimate denial of the applicability of modes of signification to God, expressed in the doctrine of divine simplicity,[101] as a permit for what Aquinas considers to be improper or even false use of words and argument: *supposito uno non supponitur aliud.* God is His Nature, but 'God' may be said to be brought forth, but 'His Nature' not. At the same time, however, Aquinas himself is necessitated to state unique logical phenomena such as *Deus* that sometimes *supponit pro essentia* despite its concrete mode and still denotes something that subsists, such as *Deus* being both a universal and a singular term, and such as *homo* that supposits (and not copulates) for a person that 'has' another substantial nature as well. Like all modes of signification, supposition falls short of representing God as He is, designed as it is to be fit for talking about creatures, but its laws should be respected as well.

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[101] "Deum cognoscimus ex perfectionibus procedentibus in creaturas ab ipso; quae quidem perfectiones in Deo sunt secundum eminentiorem modum quam in creaturis. Intellectus autem noster eo modo apprehendit eas, secundum quod sunt in creaturis; et secundum quod apprehendit, ita significat per nomina. In nominibus igitur quae Deo attribuimus, est duo considerare: scilicet perfectiones ipsas significatas, ut bonitatem, vitam, et huiusmodi; et modum significandi. Quantum igitur ad id quod significant huiusmodi nomina, proprie competunt Deo, et magis proprie quam ipsis creaturis, et per prius dicuntur de eo. Quantum vero ad modum significandi, non proprie dicuntur de Deo; habent enim modum significandi qui creaturis competit." (*ST* I 13.3).

Vivarium XXXI, 2 (1993) ©E.J. Brill, Leiden

Benedictine Masters of the University of Paris in the Late Middle Ages: Patterns of Recruitment

THOMAS SULLIVAN

Until recently, historians of medieval education have largely concerned themselves with the institutions and internal organization of schools and universities.[1] In the past decade or two, however, scholars have become increasingly interested in the broader context in which these schools and universities emerged, grew, prospered and declined. They have studied the recruitment of students and the employment of graduates as an indicator of the dialogue between society and institutions of learning. Scholars such as J. W. Baldwin have noticed that this interaction proceeds in a double direction: by tracing patterns of recruitment it indicates pressures placed on the university by the world, and by studying the employment of graduates in Church and state, it measures, to some degree, the university's impact on society.[2]

The methodology historians employ in such studies is that of prosopography, i.e., "the investigation of the common background characteristics of a group of actors in history by means of a collective study of their lives."[3] When applied to university populations, prosopography asks the questions: who went to the university? where did they come from? when did they arrive and how long did they stay? what course of studies did they follow? and what career did they choose after leaving the university?[4] The population here chosen for investigation is the *monachi nigri*, either Benedictine or Cluniac, who were promoted to the doctorate in theology or canon law at the University of Paris between 1229 and 1500. When prosopography addresses this population, it asks the question (in a modified form) found in the book of Revelation (7: 13), "*Hi qui amicti sunt stolis nigris, qui sunt et unde venerunt?*"

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[1] This article is an expanded version of a paper read at the Twenty-Seventh International Congress on Medieval Studies held in May 1992 at Western Michigan University, Kalamazoo, Michigan, during a session sponsored by the American Benedictine Academy.

[2] Recent prosopographical studies of the schools and the *studium* of medieval Paris include J. W. Baldwin, *Masters at Paris from 1179 to 1215: A Social Perspective*, in: Renaissance and Renewal in the Twelfth Century, ed. R. L. Benson and G. Constable Oxford, 1982, p. 139; Stephen C. Ferruolo, 'Quid dant artes nisi luctum?' *Learning, Ambition, and Careers in the Medieval University*, in: History of Education Quarterly, 28 (1988), 1-22; Reuven Avi-Yonah, *Career Trends of Parisian Masters of Theology, 1200-1320*, in: History of Universities, 6 (1986-87), 47-64. For a prosopography of the theologians of the University of Paris in the first third of the sixteenth century, see James K. Farge, 'Qui sunt isti theologi?' *A prosopography of Paris graduates, 1500-1536*, in: Orthodoxy and Reform in Early Reformation France: The Faculty of Theology of Paris, 1500-1543, Leiden 1985, 55-114.

[3] Lawrence Stone, *Prosopography*, in: Daedalus, 100 (1971), 46.

I have identified a total of 126 *monachi nigri*—eighty-four Benedictine and forty-two Cluniac monks—who as monks were promoted to the doctorate at the University of Paris in the later Middle Ages.[5] A number of prominent *monachi nigri*, who studied at the University of Paris but were not promoted to the doctorate there, have been excluded. These include: Guillelmus de Grimoard, the future Pope Urban V (1362-70), a doctor of Montpellier, who lectured canon law *de mane* at Paris[6] and Guillelmus de Montelauduno, a student at Paris in his youth but a doctor of a university other than Paris.[7] Also excluded from the sample is Johannes Fabri, a doctor of the University of Paris before taking the habit at the monastery of Saint-Vaast in the diocese of Arras.[8]

Many of the masters in the sample would proceed to claim the highest places in ecclesiastical administration, serving as popes, cardinals, archbishops and bishops, and abbots; other masters would hold only middling posts or none at all, serving as obedientiaries in their monasteries or priors of dependencies. This study, however, concentrates primarily on patterns of recruitment as opposed to those of future employment—focusing on chronological distribution, regional origins, and faculty choice.

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[4] Jacques Verger, *Peut-on faire une prosopographie des professeurs des universités françaises à la fin du Moyen Age?*, in: Mélanges de l'École française de Rome. Moyen Age, Temps moderne, 100 (1988), 55-62.

[5] Biographies of these masters and another 538 *monachi nigri* who attended the University of Paris during this period can be found in my forthcoming book, *Benedictine Monks at the University of Paris in the Late Middle Ages, AD 1229-1500: A Biographical Register*, to be published by E. J. Brill in Leiden in the near future.

[6] *Chartularium universitatis parisiensis*, eds. Heinrich Denifle, Émile Chatelain, Paris 1889-97, v. 3, 433, #1531 (hereafter cited as *CUP*).

[7] The most complete biography of Guillelmus de Montelauduno can be found in Paul Fournier, *Guillaume de Montlauzun, canoniste*, in: *Histoire littéraire de la France*, vol. 35 (1921), 467-503.

[8] See Jean François, *Bibliothèque générale des écrivains de l'ordre de Saint Benoît*, Bouillon, 1777-78, v. 1, 308.

[A] *Chronological Distribution*

The chronological distribution of the 126 black-monk masters can be divided into three distinct periods. The distribution shows a major concentration of masters—eighty-four, or two-thirds of the sample—clustered in the second period, in the hundred years between 1340 and 1440. Within that century peak activity took place in the generation dated 1400 to 1420, when twenty-six *monachi nigri* earned their doctorates and a total of forty-three black monks were active on the Faculties of Theology and Canon Law as regent-masters. The concentration of masters evidenced in the second period is rendered more dramatic when compared with that of the first. During the initial period—from 1215 to 1340—the *monachi nigri* produced only fourteen masters, nine Cluniac and five Benedictine.[9] Their tardy appearance on the university scene and the scarcity of black-monk masters in the first century of the university's existence may lead scholars to downplay the role of the black monks in university history, but a look at the second and third periods points to the conclusion that the *monachi nigri* had a more dominant and influential role to play than previously thought.

A look at the second part (1300-40) of this initial period reveals that the first Benedictine regent on the Parisian Faculty of Theology was Johannes de Sancto Germano, a monk of Worcester Cathedral Priory and bachelor of theology from Oxford. He left England for study in Paris in 1310, was promoted to the doctorate in theology around 1312, and was regent until 1315, when he returned to his monastery at the command of the prior of Worcester.[10] Cluniac production of masters continued during this period, only to halt around 1325, when Johannes de Lixiaco first appears in the records described as a doctor of theology.[11] The next Cluniac theologians would not appear until the

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[9] Guido de Pernes makes his first appearance in university records in quodlibetical debates dating to 1287/1288; see Palémon Glorieux, *La littérature quodlibétique*, Le Saulchoir 1925-35, v. 2, 111-2.

[10] A. B. Emden, *A Biographical Register of the University of Oxford*, Oxford 1957-59, v. 3, 1626; Palémon Glorieux, *Jean de Saint-Germain maître de Paris et copiste de Worcester*, Louvain 1947, 513-29.

[11] *Jean XXII (1316-1334). Lettres communes*, ed. Guillaume Mollat, Paris 1921-47, v. 5, 433, #22970.

1350s, when three Cluniac masters were promoted one after the other: Johannes de Pinu (*ca* 1350),[12] Simon de Brossa (*ca* 1351),[13] and Petrus de Corbeton (*ca* 1352).[14] The Cluniac general chapter of 1345, reviewing the previous twenty years, noted with chagrin that "*in domo scholarum Cluniacensium, a viginti annis citra nullus doctor sacre scientie, sive pauci baccalaurei fuerint ibidem creati...*" and tried ensure graduations by structuring and limiting the amount of time students could spend in any discipline without evident progress.[15] The negligible production of masters during this generation may reflect a decline in population in the Cluniac Order, from a high point around 1289 to a low in the period 1320-30.[16]

How can we account for the significant increase of masters in the second period, beginning in 1340 and lasting through 1440? An important consideration must be the papal bull, *Summi magistri*, published on 20 June 1336 by Pope Benedict XII (1334-42), a Cistercian and former master of the University of Paris, demanding that the *monachi nigri* send to the university one for every twenty monks and prescribing generous allowances for monk-scholars and masters.[17]

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[12] Paris, Archives Nationales LL 1337, f. 185; Pierre Anger, O.S.B., *Le Collège de Cluny*, Paris 1916, 127.

[13] On 16 November 1350 Pope Clement VI ordered the chancellor of Paris to promote Simon de Brossa to the doctorate in theology within two months (*CUP*, v. 3, 3, #1194 and n. 1). Admitted to the doctorate probably in 1351, he may have been the Simon forced to deny certain opinions put forth in his Vesper disputation in 1351 (*CUP*, v. 3, 11-12; cf. *CUP*, v. 2, 654, n. 17 to #1175). Simon de Brossa is described by Pope Innocent VI as a doctor of theology when the latter granted him the priory of St-Christophe-en-Halatte, a dependency of La Charité-sur-Loire, on 24 January 1355 (*Suppliques d'Innocent VI (1352-1362)*, ed. Ursmer Berlière, O.S.B., Rome 1911, 242, #572 and n. 3). Both Simon de Brossa and Johannes de Pinu would become abbots of Cluny, ruling respectively from 1362 to 1369 and from 1369 to 1374.

[14] Paris, Bibliothèque Nationale ms lat 5657-A, f. 1.

[15] *Statuts, chapitres généraux et visites de l'ordre de Cluny*, ed. Gaston Charvin, O.S.B., Paris 1965-82, v. 3, 392 (hereafter cited as *SCGV*).

[16] Guy de Valous, *Le monachisme clunisien dès origines au XVe siècle*, 2nd ed. rev., Paris 1970, vol. 1, 212.

[17] C. Cocquelines, *Bullarium Romanum*, Rome 1741, v. 3, 214-40. Philippe Racinet has investigated the situation of Benedictine monasticism 1300-50 for the northern half of France in his article *La réforme de Benoît XII et la situation des monastères bénédictins au nord de la Loire dans la première moitié du XIVe siècle*, in: Naissance et fonctionnement des réseaux monastiques et canoniaux: Actes du premier colloque international du C.E.R.C.O.M., St-Étienne 1991, 551-92. The reception in England of Benedict's reforming legislation—the three bulls published by Benedict XII for the reformation of the Cistercians (*Fulgens sicut stella*), of the Benedictines (*Summi magistri*), and of the Augustinian canons (*Ad decorem ecclesie*)—has been studied in Peter McDonald, *The Papacy and Monastic Observance in the Later Middle Ages: The Benedictina in England*, in: Journal of Religious History, 14 (1986), 117-32.

Benedict XII prescribed an inquiry into the possessions and resources of each house and their charges and obligations. The evidence gathered would be used to establish the number of monks to be supported in each house, which in turn would determine the number of monks to be sent to the schools.[18]

The Benedictine provinces in France began the work of the inquest in 1338; the records gathered provide a gold mine of information concerning the economic life of monasteries in the mid-fourteenth century.[19] The general chapter of the Order of Cluny in April 1339 ordered a census to be taken throughout the Cluniac provinces to determine the exact number of monks dwelling in each *domus*, so that the proper number of monks to be sent to the universities could be decided. The abbots, priors, and other administrators of the order were commanded to send their "*aptiores et meliores*" for examination for possible entrance to the universities. The chapter dealt not only with the numbers to be sent but their financial support while at the universities. Those priors who paid pensions or bursaries for the Parisian scholars were freed from any additional obligation; the remaining superiors were to pay an annual tax called a *quadrigesima*, that is, a fourth part of the tithe owed yearly to the abbot of Cluny; those priors and obedientiaries not regularly taxed would have to pay an annual tax at a rate established by two commissioners appointed by the abbot of Cluny.[20]

We have evidence that the demands of the *Summi magistri*, supplemented by the mandates of the Cluniac general chapter, were not without effect at the Cluniac house of studies in Paris; indeed their implementation may have been too enthusiastic for the situation. The Order's visitors related to the general chapter in 1342 that the new scholars, "*missi virtute constitutionum domini pape*," complained bitterly of their mistreatment at the hands of the older students. The senior scholars would not allow the new students to share in surplus funds gathered as a result of pensions for students paid by priors even though they had not sent students to the college. The *antiqui scholares* would not choose *procuratores* for the community from among the new students but only from the old and even though food was purchased from the common funds, the older students withheld salt, bread, wine and pittances from the *novi scholares*, Finally, the older students would not allow the servants of the house to wait on the new students or to prepare their food in the common kitchen.[21] The sudden influx of new students, whose financial support was derived from different sources, appears to have caused some disruption in the established economy and procedures of the house.

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[18] Cocquelines, *op. cit.*, v. 3, 210-3.

[19] Léopold Delisle, *Enquête sur la fortune des établissements de l'ordre de Saint-Benoît en 1338*, in: Notices et extraits des manuscrits de la Bibliothèque Nationale, 39 (1910), 359-408.

[20] *SCGV*, v. 3, 289-90.

An additional reason for the growth in numbers after 1340 may be the shift in the way religious—including monks—viewed the utility of a university education. Prior to the 1270s, the doctorate in theology was considered as preparatory mainly for a teaching career in the *studia* of the order; after the 1270s, the degree was also seen as a solid background for leadership in the religious orders, especially the mendicants.[22] The possibility exists that monks may have begun to attend the university in the hope of career advancement, not only within their monastery or order but also within the wider Church; they had before them the evidence of two Cluniac masters appointed bishops in the period 1300-1320: Guido de Pernes, designated bishop of Toul by Pope Boniface VIII (1296-1304) in 1306,[23] and Deodatus de Sévérac, named bishop of the newly-erected see of Castres by Pope John XXII (1316-34) in 1317.[24]

The third period, that is, from 1440 through 1500, saw only twenty-six *monachi nigri* promoted. This drop in production of masters may be a result of the two crises the university endured in the first half of the fifteenth century.[25] The year 1418 witnessed the turmoil following the

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[21] *SCGV*, v. 3, 335. In response, the definitors of the general chapter settled the matter by denying new students the right to share in the profits accruing from the pensions paid for students not sent to the house. Procurators were to be chosen from among whole community and with the consent of both *novi* and the *antiqui scholares* (*SCGV*, v. 3, 335-6).

[22] Avi-Yonah, *op. cit.*, 57-8.

[23] Conrad Eubel, *Hierarchia catholica medii aevi*, 2nd ed., Pavia 1960, v. 1, 502 (hereafter cited as *HCMA*). Avi-Yonah, *op. cit.*, 58, following Jürgen Miethke, *Papst, Ortsbischof und Universität in der Pariser Theologenprozesse des 13. Jahrhunderts*, in: Die Auseinandersetzungen an der Pariser Universität im XIII. Jahrhundert, ed. A. Zimmermann, New York 1976, 93-4, which suggests that Boniface VIII may have favored the regulars in appointments to high ecclesiastical posts.

[24] *HCMA*, v. 1, 172.

[25] Can this fall in the number of masters produced be explained by a drop in the number of sources, that is, by a reduction in the evidential base? Actually, the historian of the medieval university is better served in the fifteenth century than in either of the previous two. Two registers drawn up in the seventeenth and eighteenth

Burgundian capture of Paris and the subsequent slaughter of Armagnac supporters as well as a severe epidemic. The whole university suffered at this time: ten regents and a number of students were killed, the Collège de Navarre was ransacked, lectures were suspended in some faculties, enrollment in the faculties dropped, revenues dwindled and university privileges were contested.[26] The history of the four regent-masters of theology from the royal abbey of Saint-Denis-en-France, an Armagnac stronghold,[27] demonstrates the disruption: Johannes Generi alias Legendre, dead of unknown causes, perhaps plague, in March;[28] Benedictus Gentiani, murdered by the Burgundians in May;[29] Petrus de Versaliis, in exile at the abbey of Saint-Maixent in Poitiers after May;[30] and Philippus de Villette, abbot of Saint-Denis, dead of the plague in June.[31] The effects of this dislocation on the two faculties can be seen in the fact that the subsequent generation, 1420-40, saw only nine monks promoted to the doctorate, a significant reduction from the twenty-seven in the previous period, 1400-20.

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centuries respectively, the *Registrum Facultatis theologiae, ordo licentiatorum, 1373-1694* (Paris, B.N. ms lat 5657-A) and the *Catalogue des licenciés de la Faculté de Théologie de Paris depuis 1373-1774* (Paris, B.N. ms lat 15440) record the *licentia docendi* granted by the Faculty of Theology beginning in 1374. Of the two registers, the first—though missing information for the decade 1414 through 1424—is most useful, noting not only the names of those licensed but also the dates of the promotion to the doctorate as well as the religious order and college, where possible. Marcel Fournier's *La Faculté de décret de l'Université de Paris au XVe siècle* (Paris 1895-1942) presents the statutes of the Faculty of Canon Law at the University of Paris and, more importantly, the dean's minutes of faculty meetings held from 1415 through 1448 and from 1473 through 1503. The twenty-five year lacuna in information on canon lawyers, though regrettable, is not serious enough to call into doubt the trend begun as early as 1400 and confirmed by the production of not even one monk as a doctor in canon law in the last twenty years of the fifteenth century.

[26] Jacques Verger, *University of Paris at the End of the Hundred Years' War*, in: Universities in Politics: Case Studies from the Late Middle Ages and Early Modern Period, ed. John W. Baldwin and Richard A. Goldthwaite, Baltimore 1972, 52; Jean Favier, *Nouvelle histoire de Paris: Paris au XVe siècle (1380-1500)*, Paris 1974, 73, 229.

[27] See Guy Thompson, *'Monseigneur Saint Denis', his abbey, and his town under the English Occupation* in: Power, Culture, and Religion in France c. 1350-c. 1550, ed. Christopher Allmand, Woodbridge, Eng. 1988, 15-36.

[28] Charles Samaran, *Études sandionysiennes. II. Un nécrologe inédit de l'abbaye de Saint-Denis*, in: Bibliothèque de l'École des Chartes, 104 (1943), 55, #299.

[29] Samaran, *op. cit.*, 54, #264; *Chronique du religieux de Saint-Denys*, ed. and trans. by M. L. Bellaguet, Paris 1839-52, v. 6, 234, 246.

[30] Edmond Martène, O.S.B., and Ursin Durand, O.S.B., *Thesaurus novus anecdotorum*, Paris 1717, v. 1, 1723; Heinrich Denifle, *La désolation des églises, monastères, et hôpitaux en France pendant la guerre de cent ans*, Paris 1897-99, v. 1, 573, #1037.

[31] Samaran, *op. cit.*, 54, #263; *Chronique du religieux de Saint-Denys*, v. 6, 272.

From 1436 to 1439, the university endured a second crisis following the French reconquest of English-held territories, especially in Normandy, and another epidemic. The number of university bachelors reading fell from sixty-nine to thirty-one in canon law and thirty-one to seventeen in theology; in 1438-39, only twenty-nine regent masters could be found teaching on both faculties.[32] The number of masters produced from among the *monachi nigri* in the years 1440-60 was only six, reflecting the disorder of the previous generation, when many of the candidates for the doctoral degrees would have begun their course of studies. Around 1450, however, the university population recovered and would be fairly stable throughout the rest of the century.[33] The black monks graduated twenty-one masters of theology in the two generations between 1460 and 1500, twelve Cluniac and nine Benedictine; these figures are above the pre-1340 levels but below the level of their heyday, when an average of thirteen *monachi nigri* per generation assumed magisterial chairs. The Cluniac promotions are a reflection of the population growth in the French province of the Order of Cluny. The disturbances of the late fourteenth century and the first half of the fifteenth century had emptied the monasteries of the Order; it was only ca 1454 that the previous demographic peak, experienced ca 1289, was regained.[34]

[B] *Geographical Distribution*

A study of the regional origins of our masters needs to be carried out in two steps, the first to assess the *monasteries of profession* of the Benedictine masters and the second the *monasteries of first appearance* for the Cluniac masters. This two-stages approach is necessary because of the differences in the nature of monastic profession of the Cluniac monks and the Benedictines. Benedictines made their professions to a particular monastery, Cluniacs—for the most part—to the Order of Cluny rather than to any of its constituent monasteries. We have a fairly complete knowledge of the monasteries of profession of the eighty-four Benedictines in the sample: for forty-three our data is sure and for another thirty probable. For seven masters it is likely that they were professed at a monastery other than that at which they first make an appearance in the records. No monastery is noted for only four of the eighty-four Benedictine masters.

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[32] Favier, *op. cit.*, 74.
[33] *Ibid.*
[34] Valous, *op. cit.*, v. 1, 212.

The majority—eighty-five per cent—of the Benedictine masters with identifying monasteries originated from four regions: the first, the region of Paris (with the dioceses of Beauvais, Chartres, Meaux, Noyon, Paris, Soissons, Senlis represented), provided twenty-six masters. Normandy provided eighteen masters (from the dioceses of Avranches, Bayeux, Coutances, and Rouen); the North of France (from the dioceses of Amiens, Arras, Thérouanne, and Tournai) nine masters; and the Pays de la Loire (representing the dioceses of Angers, Le Mans, Orléans, Sens, and Tours) fourteen. Of the remaining fifteen percent, or twelve masters, three professed at monasteries in the diocese of Langres in the region of Burgundy and three others at monasteries in the diocese of Poitiers in the region of the West. Two of the more ecclesiastically successful Benedictines, Petrus Rogerii, who would become Pope Clement VI (1342-52), and Guillelmus de Chanac, promoted a cardinal in 1371 by Pope Gregory XI (1370-78), were professed at monasteries outside the main four regions sending monks to the University of Paris. Guillelmus de Chanac, a monk of St-Martial of Limoges, was the grandnephew and nephew of two bishops of Paris, Guillelmus de Chanac and Fulco de Chanac respectively; under the patronage of his uncle, he was sent to Paris for studies in canon law.[35] Petrus Rogerii, a monk of La Chaise-Dieu in the diocese of Clermont, was sent to study theology at Paris, sponsored by his abbot and the bishop of Le Puy.[36]

Because the researcher cannot be sure for the Cluniac masters that the houses named in the records are the monasteries of origin (i.e., the house at which a monk was received into the Order), the house at which the Cluniac master first makes an appearance in the records must serve as the reference point for this study. Of the forty Cluniac masters named in the sample, monasteries are named for thirty-six; three of these thirty-six monasteries are Benedictine abbeys or priories: Lagny-sur-Marne in the diocese of Paris, given to the

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[35] Guillaume Mollat, *Chanac (Guillaume de)*, in: *Dictionnaire d'histoire et géographie ecclésiastique*, Paris 1912- , v. 12, 350-1.

[36] John F. Wrigley, *Clement VI before his pontificate: the early life of Pierre Roger, 1290/91-1342*, in: Catholic Historical Review, 1970 (56), 433-73; Diana Wood, *Clement VI: The Pontificate and Ideas of an Avignon Pope*, Cambridge 1989.

Cluniac master Deodatus de Sévérac;[37] Samer-aux-Bois in the diocese of Thérouanne, the monastery where the Cluniac master Galterus de Gamaches first appears;[38] and the priory of Cayeux-sur-Mer in the diocese of Amiens, a dependency of the abbey of St-Germer-de-Flay, held by the Cluniac bachelor in theology, Petrus de Belloponte.[39] Of the remaining thirty-three, twenty-seven or 82% are from three regions: the region of Paris provided fifteen masters; that of the North, five masters; and Burgundy, seven masters, five of the latter from the mother house of Cluny in the diocese of Mâcon. Notably absent from the list is the region of Normandy and the Pays de la Loire; Cluniac monasticism, never strong in these territories, was represented by only seven small priories in Normandy and four in the Pays de la Loire.[40]

As would be expected, there is a fairly strong correlation between the number of Cluniac monasteries noted in the roster of monasteries of first mention and the Cluniac houses responsible for maintaining students in the Collège de Cluny. Of the sixteen Cluniac monasteries listed, ten (including the mother house of Cluny) had this right and obligation.[41] The remainder among the monasteries of first mention were one each from Savoie, the Franche-Comté, the Dauphiné, the region of the Northeast, and the Low Countries.

Analysis of the total sample—Benedictines and Cluniacs combined—reveals that eight out of ten masters originated in the northern half of France and from five regions in particular. The largest concentration of masters—forty-two—came from the region of Paris. Normandy provided eighteen masters, the North of France sixteen masters, and the Pays de la Loire fourteen. The fifth region, Burgundy (with representatives from the dioceses of Auxerre, Langres, and Mâcon), produced ten masters. The remaining twenty-two monks came from seven additional regions, including the previously mentioned English monk, Johannes de Sancto Germano, monk of Worcester Cathedral Priory. In the whole sample, thirty-three dioceses are represented and sixty-two monasteries. This picture of monastic recruitment mirrors that of the University of Paris at the beginning of the fifteenth century: it is a university of the northern half of France with strong representation from Normandy, the Paris basin, Picardy, French Flanders, and Champagne.[42]

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[37] Denis de Sainte-Marthe, *Gallia Christiana in provincias ecclesiasticas distributa*, Paris 1715-1865, v. 7, c. 502.

[38] *Ibid.*, v. 10, c. 1096.

[39] *Le Livre des prieurs de Sorbonne (1431-1465)*, ed. Robert Marichal, Paris 1987, 171, #611.

[40] *SCGV*, v. 6, 326, 328.

[41] For a full list of Cluniac houses obliged to maintain scholars at the Collège de Cluny see Anger, *op. cit.*, 27, n. 1.

A comparison of regional origins of masters in the fourteenth century with masters of the fifteenth century shows that as the middle ages progressed, the catchment area diminished. In the fourteenth century, eight out of ten of the black-monk masters came from the five major regions mentioned above; they were drawn from twenty-seven dioceses and forty-four monasteries. In the fifteenth century, however, the same five regions produced nine out of ten masters, and only two came from outside the northern half of France. The number of dioceses represented decreased from twenty-seven to twenty-one, and the number of monasteries from forty-four to thirty-three. Just as the university's geographic base in northern France became much more evident in the fifteenth than in the fourteenth and thirteenth centuries, so the zone of monastic recruitment increasingly restricted itself to the same regions.

The population decline and contraction of the recruitment area—especially after 1440—reflects not only that era's political troubles but also competition from universities newly created in the fifteenth century: the University of Dôle in 1423, that of Louvain in 1425, of Poitiers in 1431, that of Caen in 1432, and the University of Nantes in 1461.[43] Monks were now able to attend universities closer to home and perhaps less expensive.

The greatest producers of masters were the influential Parisian houses of Saint-Martin-des-Champs and Saint-Denis-en-France, eleven and eight respectively, and Marmoutier with eight. The Norman abbey of Fécamp saw six of its monks promoted, while Cluny was responsible for five and Corbie four. These six monasteries—out of sixty-two sending monks to the university—were responsible for one-third of the sample. Each of these monasteries enjoyed great wealth, as revealed by an examination of the *servitia communia*—dues amounting to one-third the gross annual income paid the Apostolic Camera by bishops and abbots on the occasion of their nomination, on the confirmation of their election, on their consecration, and on their translation to another see or abbey.[44] Of all the monasteries in Europe, those assessed the highest sums were Cluny and Fécamp at 8000 gold *florins*, Marmoutier at 7000, and Corbie and Saint-Denis-en-France at 6000 old *florins* each[45]—a good match with those monasteries generating the highest number of masters, if Saint-Martin-des-Champs is subsumed under Cluny.

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[42] Jacques Verger, *Le recrutement géographique des universités françaises au début du XVe siècle d'après les suppliques de 1403*, in: Mélanges d'archéologique et d'histoire, 82 (1970), 894.

[43] Astrik L. Gabriel, *Universities*, in: *Dictionary of the Middle Ages*, New York 1982-89, v. 12, 285.

[C] *Course of Study*

When *monachi nigri* arrived at the University of Paris their choice of faculty was limited by law and tradition to the study of theology and canon law. The study of medicine was forbidden and the study of the arts unnecessary (monks had theoretically prepared for work on the higher faculties by training in the *scientia primitiva* in their home monasteries). The majority of black monks in the sample chose theology over canon law—the ratio stands at three to two; though it should be noted that for a time, from 1360 through 1400, the number of canon lawyers promoted outnumbered the theologians by more than two to one.

The first black-monk canon lawyers promoted do not appear until 1349—ninety years after the appearance of the first monk-theologian in 1259. Why did it take so long for the *monachi nigri* to involve themselves in the study of canon law? A possible explanation may be found in the demands of the canons themselves. The intent of canon law was that monks should neither study nor practice law of any kind, civil or canon; exceptions were to be rare and only under special circumstances. Indeed, Pope Boniface VIII held that any monk studying law was excommunicated *ipso facto.*[46] By 1336, however, the situation had changed; Pope Benedict XII, in the *Summi magistri*, not only demanded that a quota of monks be sent to the university for advanced study but also provided for the study of canon law as well as that of theology.[47]

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[44] G. Mollat, *The Popes at Avignon, 1305-1378*, London 1963, trans. from the ninth French edition, 319.

[45] M. H. Hoberg, *Taxae pro communibus servitiis solvendis, ex libris Obligationum ab anno 1295 ad annum 1455 confectis*, Vatican City 1947, 374.

[46] *Corpus iuris canonici*, ed. Emil Friedberg, Leipzig 1879, v. 2, 1065 (VI° 3.24.2).

[47] *CUP*, v. 2, 463, 464, # 1002: "*Quia expedire dinoscitur ut postquam monachi in scientiis primitivis eruditi fuerint, ad sacre theologie vel canonum transeant facultates, statuimus et ordinamus ut ecclesie, monasteria, prioratum et alia loca hujusmodi singula... de quolibet vicenario*

Three years later, on 30 April 1339, Benedict felt it necessary to compel under pain of ecclesiastical censure the masters of the Parisian faculty of canon law to admit black monks to lecturing on the *decretum* as well as the decretals. He gives no reason for this move, except to state that there is no profit in promulgating statutes (presumably in the *Summi magistri*) unless they can be put into practice.[48] Perhaps the canon lawyers, fearing an on-slaught of black-monk masters, refused to admit the monks to the magisterial chair, basing their opposition on Boniface VIII's antagonism to monastic lawyers and on the monastic reputation for litigiousness.[49] A more likely explanation for the Faculty of Canon Law's reluctance may have been the need to restrict the number of "chairs" in canon law, maintaining thereby the prestige of chair-holding and guaranteeing that faculty income would not diminish because of the need to share that income among a greater number of masters.

The first *monachi nigri* to surface as masters on the Parisian faculty of canon law appear on a *rotulus* seeking benefices of Pope Clement VI in 1349. The petition names three Benedictine monks among the seventeen canon lawyers seeking papal favors: Johannes de Sancto Dionysio, monk of Saint-Laumer in the city of Blois; Petrus Amelhii, prior of Alloue, a dependency of Charrou; and Robertus Couroye, professed of the Norman monastery of Le Bec-Hellouin. The entry for Johannes de Sancto Dionysio supplies the helpful information that he was the first of the Benedictines to be promoted to the doctorate, presumably in canon law (*primitus doctorato Parisius inter sui Ordinis professores*).[50]

In the sample, Benedictine and Cluniac theologians were almost equal in number, but Benedictine canon lawyers outnumbered Cluniac canon lawyers nine to one. This dramatic difference may be attributed to the fact that, for the most part, the Cluniac Order used other universities for the study of canon law—Orléans, Toulouse, Montpellier, and Avignon[51]—and that the Collège de Cluny in Paris

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numero monachorum unum aptum pro fructu majoris scientie acquirendo ad generalia seu solemnia studia mittere teneantur...." The bull legislates furthermore the amount to be paid theologians and canon lawyers for their support at the *studia*, the amount of time allowed for the various stages of the academic *cursus* both in theology and canon law; cf. James Brundage, *The Monk as Lawyer*, in: The Jurist, 39 (1979), 425, 430.

[48] *CUP*, v. 2, 628, #1163.

[49] Brundage, *op. cit.*, 428.

[50] *CUP*, v. 2, 628, #1163.

[51] *SCGV*, v. 1, 137, #110, 168, #166.

was founded primarily for theological studies.[52] Of the fifteen Cluniac masters known to have been members of the Collège de Cluny, all of them were graduates in theology, none in canon law. The Order of Cluny did, however, make a serious attempt to foster the study of canon law at Paris. At the general chapter of 1378, the abbot of Cluny ordered that six of the priors who had each formerly maintained a theologian at Paris should now be responsible for canon lawyers; that the priors of Saint-Martin-des-Champs and La Charité-sur-Loire, who had each maintained two theologians, should now each support one theologian and one canon lawyer; and that two of the four pensions for which he held himself responsible should be transferred from support of those studying theology to that of two monks studying canon law. These canon lawyers would not take up residence at the Collège de Cluny but would live at another Cluniac priory in Paris, Saint-Julien-le-Pauvre, a dependency of the priory of Longpont with a long and close association with the university.[53]

Regional production of theologians and canon lawyers from the University of Paris shows some striking differences. Two regions, the North and Burgundy, sponsored equal numbers of canon lawyers and theologians. The regions of Paris and of the Pays de la Loire each produced double the number of theologians than canon lawyers. The reputation of the Parisian faculty of theology as well as the easy access scholars in these latter two regions had to other prominent centers of legal studies, primarily the University of Orléans, may explain the numerical disparity. Normandy generated almost three times as many canon lawyers as theologians. The Norman preference for canon law depends perhaps on the great wealth of the Norman abbeys and the notion that where there is wealth, there also are lawyers. According to the assessments made for the *servitia communia*, the eighteen monasteries of *monachi nigri* paying the highest rates (from 8000 to 4000 gold *florins*)[54] included three of the seven monasteries sending monks to Paris for canon law studies: Fécamp, Saint-Ouen in Rouen, and Saint-Wandrille. An additional two of the seven Norman houses were at the next level of assessment at 3000 gold florins: Le Bec-Hellouin and Jumièges.[55] It should be noted that until the foundation of the faculties of law at the University of Caen in 1432 the University of Paris was the closest to the Norman monasteries with a faculty of canon law, prestigious and useful in obtaining career advantages for its graduates.

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[52] *SCGV*, v. 1, 65, #18.

[53] *SCGV*, v. 4, 130. Saint-Julien-le-Pauvre served the university as a meeting place for the election of its rector and for the ceremonies making new masters of arts as well as for meetings of the Arts faculty and of the nations. In October 1379, six months after the abbot of Cluny ordered Saint-Julien-le-Pauvre to serve as the residence for students of canon law, the university begged Pope Clement VII to grant visitors to Saint-Julien-le-Pauvre indulgences, so that necessary repairs could be made to the priory and the divine office could be celebrated (*SCGV*, v. 3, 245). The university would pay for the restoration of the priory's windows in 1458 (*SCGV*, v. 5, 236).

[54] Hoberg, *op. cit.*, 374 provides the following information on taxation rates for the great monasteries of France: Cluny, Fécamp, Saint-Germain-des-Prés (until 1387)

Conclusion

Because the nature of our sources precludes rigorous investigations into the mobility, power, and motivations of a group such as the masters of Paris among the *monachi nigri* in the late middle ages, a prosopographical study such as this can only have the simple goal of learning as much as possible about the geographical origins and educational choices of university monks living during a period of history when death and renewal confronted each other in dramatic fashion. Future research, focusing on the careers of these monks and the role they played on the individual university faculties, will help the historian understand the complex interaction of the university and a monasticism insufficiently studied and perhaps harshly and unjustly judged.

Conception, Missouri
Conception Abbey

(8000 *fl.*); Marmoutier (7000 *fl.*); Corbie, Saint-Denis-en-France (6000 *fl.*); Saint-Rémi (5200 *fl.*); Saint-Pierre in Ghent (5000 *fl.*); Anchin, Saint-Vaast d'Arras, Déols, Saint-Bavon in Ghent, Moissac, Molesmes, Saint-Germain-des-Prés (from 1387), Saint-Ouen in Rouen, Saint-Riquier, Saint-Wandrille, Saint-Martin de Tournai (3000 *fl.*).

[55] Hoberg, *op. cit.*, 222, 297.

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On the Self-Refuting Statement "There is no Truth": A Medieval Treatment

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It is commonly known that 14th and 15th century logicians were deeply interested in the properties of self-referring statements. Perhaps, however, it could be better known that medieval theologians were also interested in them. In this regard, one important discussion centered around the proposition "There is no truth" ("*Nulla veritas est*"). Construed as a universal negative about an entire class of items of which it itself is a member, it is partially self-referring. And just because it is self-referring it also seems to be self-refuting: if it is true, then it is false; if it is false, then something is true. Thus, its contradictory is necessarily true, namely "There is some truth".

The history here goes back many centuries through a line of theologians and ultimately to St. Augustine.[1] Following him, St. Anselm, St. Bonaventure, and others claimed to have found in the self-refutation of the denial of truth a foundational premise adequate to support other claims about God and immortality. But this was not without opposition from theological colleagues and successors, including Aquinas, Scotus, and in the post medieval period, Cajetan, and Toletus. Criticism came at either of two points: the critics objected (a) that the self-referring character of the denial of truth does not entail the truth of what is claimed, or (b) that the truth which the self-refutation is purported to establish is not itself sufficient to found the metaphysical constructions it is further claimed to found.

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[1] Interest in self-refutation is common among ancient Greek and Hellenistic philosophers. Sextus Empiricus provides a notable statement of the alleged self-refutation of the proposition in which we are interested. Sextus Empiricus, *Against the Logicians*, I 398-9, II 55, ed. and tr. R.G. Bury, *Loeb Classical Library*, Cambridge 1935, II, 213, 265. "Now as to those who assert that all things are false, ... they are confuted. For if all things are false, the statement 'All things are false, ' being one of the 'all things', will be false. And if the statement 'All things are false' is false, its contradictory, 'Not all things are false,' will be true. Therefore, if all things are false, not all things are false." (p. 265) For the history of the notion of self-refutation, see M.F. Burnyeat, *Protagoras and Self-Refutation in Later Greek Philosophy*, in: The Philosophical Review, 85 (1976), 44-69.

An unraveling of this ancient debate—beginning our story with Augustine in the 4th century and ending it with Toletus in the 16th—reveals the appreciation among these theologians of ever more powerful tools of logical analysis, tools that have proven to be of lasting use.

I. Self-Reference

As a preliminary, let us make a few comments about self-reference. Not every self-referring statement is logically problematic; for evidence, take the statement, "This sentence contains five words". However, some are problematic: they are either (i) self-refuting or (ii) paradoxical.[2] Our sentence "There is no truth" can be either, depending upon assumptions about the context of its assertion.

(i) Consider first self-refutation. Self-referring statements that are merely self-refuting undermine only themselves and not the whole apparatus of thought, as do paradoxes. Several sorts of self-refutation have been distinguished. To locate ourselves, consider each sort briefly. Of concern to us is the *absolutely* self-refuting statement: a statement that is falsified by its own content. Assuming that the operator "it is true that" is prefixable to any statement, then the statement "There is no truth" is absolutely self-refuting: if there is no truth, then *it is true that* there is no truth; but this entails in turn that there is truth; so the original statement entails its own falsity, and its opposite, "There is some truth", is necessarily true. The reasoning here turns on the assumption of the necessary prefixability of the operator "it is true that." As we shall see, the prefixability assumption is a central point of dispute among the theologians. Modern logicians have identified several other sorts of self-refutation.[3] A *pragmatically* self-refuting statement is one in which the way the statement is presented is inconsistent with the content of the statement, as when one writes "I am not writing". This sentence would not be self-refuting, of course, were the mode of its expression an utterance rather than an inscription. An *operationally* self-refuting statement is one whose content is such that it is in conflict with any assertion of the statement, no matter in what manner one may choose to assert it. "I believe nothing" is operationally self-refuting, since anyone who asserts anything is implicitly committed to the expanded statement that one believes that which one asserts. In this case, one would be committed to the incoherence that one believes that one believes nothing. Now it may be that in fact one believes nothing and merely happens to say so, but, the statement is nonetheless absurd, although true. Other operationally self-refuting statements include "I am not thinking", "I know nothing", and "No statement is intelligible", since in asserting any statement *p*, one is implicitly committed to the expanded statements "I believe that *p*", "I know that *p*", and "It is intelligible that *p*". Thus to say "No statement is intelligible" is to be committed implicitly to the expanded statement, "It is intelligible that no statement is intelligible".

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[2] For another discussion of the distinction between merely self-refuting and authentically paradoxical self-reference, see A.N. Prior, *On a Family of Paradoxes*, in: Notre Dame Journal of Formal Logic, 2 (1961), 16-32.

[3] Our discussion of the types and properties of self-refutation is taken from J.L. Mackie, *Self-Refutation—A Formal Analysis*, in: The Philosophical Quarterly, 14 (1964), 193-203.

(ii) Consider next paradoxical self-reference. The sentence "This sentence is false" is paradoxical in the extreme: if it is true, then it is false; if it is false, then it is true; thus, it is true if and only if it is false. Since the conclusion of this line of reasoning is a formal contradiction, and since it is reached by accepted ways of reasoning from individually credible premises, we are at a point of crisis and must meet a challenge to the rationality of our way of thinking. If it is assumed that our statement "There is no truth" is the only statement made, then it too would be a paradox generating statement.

Historically, several ways out of paradox crises have been pursued:

(a) Deny that this or any statement purporting to be self-referring (call it "S") achieves what it purports. In this way, one rejects the premises of the crisis generating argument. Historically, this is the approach of Ockham among medievals and Austin among moderns.[4]

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[4] William of Ockham is interpreted as at least denying that those propositions are self-referential which, if they were such, would generate paradoxes. See his *Summa Logicae* III, 3, c. 46, in: *Opera philosophica*, ed. Boehner, Gal, et Brown, I, 476-78, St. Bonaventure, N.Y. 1974. But see Paul Vincent Spade, *Ockham on Self-Reference*, in: Notre Dame Journal of Formal Logic, 15 (1974), 298-300.

John Austin denies that any statement purporting to refer to itself—that is, to state its own truth value, or to state what it itself refers to—does in fact do so. On this account, the statement "Every statement is false", uttered with the intention of self-reference, "misfires" in failing to achieve the reflexivity intended. Its "absurdity" rests in its being a performative failure and not in its generating a logical contradictions, since the latter would require successful self-reference. The way out of paradox,

(b) Deny that the laws of logic—specifically those of bivalence or of the excluded middle—apply to statement S. The idea here is that statement S is taken to be neither true nor false, consequently, no self-contradiction emerges. Russell and Whitehead and some Wittgensteinians take this way of meeting the challenge.[5]

(c) Accept the fact that statement S is self-referential and that the classical laws of logic apply to it, recognizing the inconsistency of any language allowing for both of these conditions. In turn, construct a hierarchy of languages, free of this inconsistency. Tarski offers this alternative.[6]

(d) Avoid the crisis by denying the implication of a vicious circle. Recognizing that the truth of statement S implies its own falsity, deny that its falsity implies its truth, on the ground that the truth-conditions

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then, is the simple expedient of disciplining one's use of the natural language. There is no need for its radical reconstruction, say, as a hierarchy of (ideal) languages in which even the purport of self-reference is impossible. See his article, *Truth*, in: *Philosophical Papers*, ed. J.O. Urmson and G.J. Warnock, Oxford 1961, 92nl, 94n2, 96-7n2, and *How To Do Things with Words*, ed. J.O. Urmson, Oxford 1962, esp. 16, 18, 135-8.

[5] Bertrand Russell and Alfred Whitehead claim that "statements about 'all propositions' are meaningless" and, hence, neither true nor false. As such, the logical laws of bivalence and the excluded middle are inapplicable to them, and the logical derivation of any self-contradiction is only apparent. See their *Principia Mathematica*, Cambridge 1910, I, esp. 37, 61. The same claim is made by Jørgen Jørgensen in *Some Reflections on Reflexivity*, in: Mind, 63 (1953), 289-300.

Garth Hallet, in the tradition of Wittgenstein, would dissolve the problem by denying that paradox-generating statements are either true or false. The idea is that statements such as "Every statement is false" lack an appropriate background of usage and, hence, a norm for determining a truth value. Accordingly, if the laws of logic require that any indicative sentence or statement be either true or false, "so much the worse for the laws of logic." See his *Language and Truth*, New Haven 1988, 137-8, 190-4.

[6] Alfred Tarski does not deny the meaningfulness of self-referring statements that generate paradoxes; he reasons that since they logically imply contradictions, they must be true and false. Because such sentences do have contradictory implications, any language in which they have a home—for instance, any natural language—is riddled with "antinomies." In order to secure a self-consistent language, Tarski stipulates an exclusionary rule: no self-referring sentence is a part of the language he uses. Accordingly, the sentences "Every sentence is false" is admissible only if it is construed as a higher order sentence in a "meta-language" about lower order sentences (not including itself) in its "object language." See Tarski, *The Semantic Conception of Truth and the Foundations of Semantics*, in: Philosophy and Phenomenological Research, 4 (1944), 52-84, esp. 58-62. J.L. Mackie [*Truth, Probability and Paradox*, Cambridge 1973, 242-3] defends the meaningfulness of reflexive sentence such as "Every statement of false".

of the statement are not satisfied, since it is false. Statement S then is merely false. This is the approach of John Buridan.[7]

In this connection, let us also remark certain problems connected with the translation and reconstruction of the arguments originally set in medieval Latin texts. It is often difficult to determine the supposition of an expression, that is, whether it is intended to be concerned with a real state of affairs, the proposition or concept formed in the mind in thinking of that state, or autonymously, with itself as a linguistic item. The medievals did not have Frege's device of systematically indicating autonymy by quotation marks about the expression mentioned. While at times medieval authors partly make up for such lack by using the Old French article "ly", or later the Greek "τό", there is no consistency among them in this. This must be coupled with the difficulty of translating the Latin accusative and infinitive in indirect discourse. Making for even more problems is the lack of either a definite or an indefinite article in Latin. This, together with the accusative and infinitive difficulty, frequently clouds the issue of supposition. On occasion, such complications have confused the medievals themselves and have made it hard for them as well as for us to separate logical or linguistic issues from issues that are epistemological or even metaphysical.

In light of these difficulties, the adoption of certain conventions is in order. We use double quotation marks around words or sentences to signify that they are being mentioned, rather than used. Single quotation marks are used to set off sentences mentioned within sentences that are themselves mentioned, or to mark sentences that are the direct discourse of an author being discussed. To set the stage chronologically, especially where the text is short, we for the most part give exact translations and reproduce the Latin in footnotes. But as the discussion develops, and as we encounter later thinkers summarizing earlier ones, we are content with close paraphrases of relevant texts. Within translations brackets, "[ ]", are used to indicate words not expressed but understood in the original text. Parentheses, "( )", are employed for alternative translations and also to highlight Latin words. Usually, these will involve sentences in direct discourse, as opposed to states of affairs which they express.

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[7] J. Buridan, *Sophismata*, c. 8, n. 7 & n. 11, in: *John Buridan: Sophisms on Meaning and Truth*, tr. T.E. Scott, New York 1966, 191-200, 203-6; *idem, Tractatus de consequentiis*, I, c. 5, ed. Hubien, Louvain 1976, 26. See also E.A. Moody, *Truth and Consequence in Mediaeval Logic*, Amsterdam 1953, 103-10.

II. The Augustinian Argument

0. The Basic Argument

Not until Bonaventure are we given the fullest statement of the argument for the existence of God from the self-refutation of truth's denial, as it might well be named. With an eye on his work, we begin with a formal reconstruction of the complete argument. In this way, we can more easily track Augustine, Anselm and Bonaventure's cumulative elaborations of a complete and coherent argument, and we give ourselves a common point of reference in discussing those premises that become objects of debate among Aquinas, Scotus, and the others, who challenge its premises.

Informally, the argument is this: If there is no truth, then it is true “there is no truth”. Moreover, if this is true, then something is true. But it also follows that if there is no truth, then there is no truth. Hence, the denial of truth implies a contradiction. But no proposition implying a contradiction can be true, so it is not true that there is no truth, or, in other words, there is truth. Now if there is truth, then there is God who is the primal truth. Hence God exists.

To formalize the argument, let “T” mean “There is something that is true”, “ ‘T’ ” (in single inverted commas) be the name of the proposition “T”, and “G” mean “Primal Truth, which is another name for God, exists”. As in modern logic, let “-” and “&” be the signs of negation and conjunction, respectively. To capture the practice of our medievals, let “-->” be the sign of the conditional, where “p --> q” is true if and only if “p & - q” is not possible. Accordingly, this conditional connective is stronger than the material implication of modern logic. Let “d” stand for the proposition-forming operator “it is true that”. “⊢” is our sign for strict implication; it can conveniently be read as “therefore”. The argument is displayed as follows:

	(S1)	- T --> d ‘- T’	*Modal Premise*
	(S2)	d ‘- T’ --> T	*Modal Premise*
⊢	(S3)	- T --> T	from (S1) and (S2)
	(S4)	- T --> - T	*Tautology*: p --> p
⊢	(S5)	- T --> (T & - T)	from (S3) and (S4)
	(S6)	- (T & - T)	*Tautology*: - (p & -p)
⊢	(S7)	- - T	from (S5) and (S6)
⊢	(S8)	T	from (S7)
	(S9)	T --> G	*Metaphysical Premise*
⊢	(S10)	G	from (S8) and (S9)

Since the argument is valid, the interesting objections of critics focus on one or more of the premises. Modal premises (S1) and (S2), tautology (S4), and the metaphysical premise (S9) are targets of productive controversy, provoking employment of important analytical distinctions. We begin with the earliest presentation of the argument in Augustine.

1. St. Augustine

St. Augustine (354-430) appears to be the first theologian to be concerned with the self-refutation of the denial of truth. This concern occurs in his *Soliloquies*, where, within an argument for the immortality of the soul, he has argued for the eternal character of truth as follows:

> Even if truth should perish, would it not be true that truth had perished? ... But something could not be true, if truth were not.... Accordingly, in no way will truth perish.[8]

The rhetorical question in this quotation amounts to the claim that if truth perished, then it would be true that truth perished. The second claim is that if truth perished, then it would not be the case that anything were true, including, presumably, that truth perished. Given these implications of the supposition of truth's perishing, Augustine draws the conclusion that it is not the case that truth might perish. The underlying logic of his argument is this: any supposition that implies a contradiction must itself be false. Put schematically: $p \dashrightarrow (q \,\&\, -q) \vdash -p$. The contradiction Augustine sees is, presumably, a function of the indirect self-reference of the idea of all truth perishing, including the truth about itself. Thus, we have here the core of the argument that is elaborated down the centuries among Christian theologians.

2. St. Anselm

In the prologue to his *Monologium*, St. Anselm of Canterbury (1033-1109) declares his adherence to the thoughts of St. Augustine. In line with this, it is no surprise to find in this same *Monologium* (chapter 18) a paraphrase of the Augustinian argument on the eternity of truth. With Anselm it is explicitly spelled out in two directions. Truth has neither a beginning nor an end. For if one conceives a situation before truth began to be, it would then be true that truth is not yet. And equally, if one thinks of a situation in which truth has perished, it would then be true that truth is not any more. In either case, since something cannot be true without the existence of truth, truth would exist, when by supposition it did not exist—that is, before any supposed beginning or equally after any supposed end of truth, truth exists.[9] But since each of these implications is "most unfitting" (*inconvenientissimum*), it would follow that truth is eternal. Anselm later in two places in his treatise *On Truth* makes the same argument.[10]

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[8] "Quid si ipsa veritas occidat, nonne verum erit veritatem occidisse? ... Verum autem non potest esse, si veritas non sit. ... Nullo modo igitur occidet veritas." *Soliloquia*, II, c. 2, n. 2, in: *Obras de San Augustin*, ed. P. Felix Garcia, O.S.A., Madrid 1957, I, 548.

3. St. Bonaventure

In the thirteenth century, St. Bonaventure (1221-1274) has taken up the Augustinian reasoning in at least four places. In the First Book of his *Sentences Commentary*, d. 8, pars. 1, art. 1, qu. 2, he has raised the question "Whether the Divine Reality is so true that it cannot be thought not to be?" (*Utrum divinum esse est adeo verum quod non possit cogitari non esse.*) Among the arguments he gives in support of an affirmative answer is the following:

> No sentence (*sermo*) is more negative than this: "there is no truth" (*nulla est veritas*). But Augustine in the *Soliloquies* shows that this sentence entails (*ponit*) that some truth exists. For if no truth exists, it is true that no truth exists. And if this [sentence] is true, something is true. And if something is true, then some truth exists.[11]

While Bonaventure agrees with an affirmative answer to the principal question concerning the Divine Reality, he does have reservations about this last argument, and, in effect, challenges modal premise (S1) of the basic argument above. Thus in the body of his response he writes: [Note: Any bracketed numbers within any block quotation in this paper key the statement immediately following the number one of the ten lines of the basic argument above.]

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[9] Cf. "Denique si veritas habuit principium vel habebit finem: antequam ipsa inciperet, verum erat tunc quia non erat veritas; et postquam finita erit, verum erit tunc quia non erit veritas. Atqui verum non potest esse sine veritate. Erat igitur veritas antequam esset veritas; et erit veritas postquam finita erit veritas; quod inconvenientissimum est." *Monologium*, c. 18, ed. F. Schmitt, in: *Obras de San Anselmo*, Madrid 1952, I, 238.

[10] Cf. *De Veritate*, cc. 1 and 10, Madrid 1952, I, 490, 520.

[11] "... nullus sermo est magis negativus quam iste: nulla est veritas. Sed Augustinus, in *Soliloquiis*, probat quod sermo iste ponit aliquam veritatem esse; quia si nulla veritas est, verum est nullam veritatem esse; et si hoc est verum, aliquid est verum, et si aliquid est verum, aliqua veritas est: ergo etc." In I. *Sent.*, d. 8, pars 1, a. 1, q. 2, g, in: *Opera theologica selecta*, ed. minor, Quaracchi 1934, I, 119.

> A negative proposition does not imply that [God or truth exists] except in a sophistic way. Hence, from this that nothing exists or that there is no truth, it is not possible to conclude or infer that truth exists. For this proposition, "Nothing exists" (*nihil esse*), destroys all truth. Therefore, from it there does not follow any affirmation and this is false: "If nothing exists, it is true that nothing exists" [(S1)]. And if it is said that every proposition implies what it says, that is so but if there is nothing, there is no proposition nor anything else. Augustine, moreover, does not make such an argument with approval, but rather by way of inquiry.[12]

Within a year or so of writing this, however, St. Bonaventure in his *De mysterio Trinitatis*, Q. I, art. 1 (*Utrum Deum esse sit verum indubitabile*), gives a more detailed presentation and reverses his unfavorable evaluation of St. Augustine's argument. Thus in argument 26 (out of 29) in support of an affirmative answer to the question raised in article one, he presents St. Augustine's argument with the modal premises (S1) and (S2), and the metaphysical premise (S9) as underived premises:

> Whatever can be thought, can be enunciated. But in no way can it be enunciated that God does not exist (or as a possible translation of the accusative and infinitive construction: "God does not exist") without it being enunciated with this that God does exist (or "God exists"). This is clear as follows: if there is no truth, it is true that there is no truth [(S1)]; and if this is true, then something is true [(S2)]; and if something is true, the First Truth Exists [(S9)]. Thus, if it cannot be enunciated that God does not exist [or "God does not exist"], neither can it be thought [(S10)].[13]

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[12] "Propositio autem negativa non infert ipsam nisi sophistice, ut dicunt. Unde ex hoc quod est nihil esse, vel nullam veritatem esse, non contingit concludere nec inferre, veritatem esse. Haec enim propositio: nihil esse, destruit omnem veritatem. Et ideo ad ipsam non sequitur aliqua affirmatio, et haec est falsa: si nihil est, nihil esse est verum. Et si dicatur, quod omnis propositio infert dictum, verum est, sed si nihil est, nulla propositio est nec aliquid. Augustinus autem tale argumentum non facit approbando, sed inquirendo." *ibid., in corp.*, p. 120. Note the phrase "Haec enim propositio, nihil esse" here as bringing out some of the ambiguity inherent in Latin grammar; cf. also note 14, below.

[13] "Quidquid contingit cogitare contingit enuntiare; sed nullo modo contingit enuntiare, Deum non esse, quin cum hoc enuntietur, Deum esse. Et hoc patet sic: quia, si nulla veritas est, verum est, nullam veritatem esse; et si hoc est verum, aliquid est verum, et si aliquid est verum, primum verum est: ergo si non potest enuntiari, Deum non esse, nec cogitari." *De mysterio Trinitatis*, I, 1, n. 26 *quod sic*, in: *Obras de San Buenaventura*, ed. Aperribay, Oromi, y Oltra, Madrid 1958, V, 104.

The balance of the underived premises of the complete argument, namely, the tautological premises (S4) and (S6), is introduced by Bonaventure in the process of answering a possible objection. In his *rationes ad contrarium*, Bonaventure considers two objections, numbers 4 and 5, of which number 5 specifically questions whether conclusion (S8), the affirmation "There is truth", "T", is ultimately derivable from its opposite, the denial of truth, "-T", the antecedent of the modal premise (S1). This objection we translate as follows:

> Against the reasoning of Augustine, when he proves that through this proposition, "There is no truth" (*nulla veritas est*) [the antecedent of (S1)], there is implied this that there is some truth [(S8)], it is objected: if there does result (*est*) this true proposition, namely, "There is some truth", it has a [character] contradictory [to its antecedent]. But no one contradictory implies or posits, indeed rather it takes away, its opposite. Therefore, through this proposition, "There is no truth", it is not to be concluded that some truth exists.[14]

In his reply to the overall question in article 1 here in the *De mysterio Trinitatis*, St. Bonaventure has accepted all of the arguments on the affirmative side. No longer does he show any of the hesitation he has in the *Sentences Commentary*. In particular then, replying to argument 5 *ad contrarium* as just stated, he distinguishes two different sorts of implication of any proposition: (a) any proposition implies itself: $p \dashrightarrow p$; and (b) any proposition also implies the assertion of itself: $p \dashrightarrow d\ `p'$. Thus, the proposition "There is no truth" implies the proposition "There is no truth" (tautological premise (S4)), and it also implies the proposition " 'There is no truth' is true" (modal premise (S1)), which in turn implies that there is truth (modal premise (S2)). And hence, from these conditional propositions, a contradiction follows (conclusion (S5)). But since no contradiction is true (premise (S6)), it follows that it is not the case that there is no truth (conclusion (S7)), or equivalently, there is truth (conclusion (S8)). As Bonaventure puts it:

> To that which is objected against the reasoning of Augustine, that a contradictory does not imply its contradictory, it must be said that this is true insofar as it is a contradictory. But it must be understood that an affirmative proposition

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[14] "Item, obiicitur contra rationem Augustini, quando probat, quod per hanc propositionem: nulla veritas est, infertur, aliquam veritatem esse. Si enim est haec propositio vera: aliqua veritas est, habet ergo contradictoriam; sed nulla contradictoria infert vel ponit, immo potius privat suam contradictoriam; ergo per hoc quod est, nullam veritatem esse non concluditur, aliquam veritatem esse." *ibid.*, 5 *quod non*, p. 106. Again for the vagaries of Latin grammar, compare the phrases "*hanc propositionem: nulla veritas est*" and "*haec propositio: aliqua veritas est*" here with the "*Haec enim propositio, nihil esse*" in note 12 above.

> has a twofold affirmation: one, by which it asserts a predicate of a subject, and another, by which it asserts itself to be true. In respect of the first, it is distinguished from a negative proposition, which removes a predicate from a subject. But in respect of the second, it is the same [as a negative proposition], for both a negative and an affirmative proposition assert themselves to be true [(S1)]. With respect to the first—but not the second—there is a contradiction. But when it is said, "there is no truth" (*nulla veritas est*), this proposition insofar as it denies a predicate of a subject does not imply its [contradictory] opposite, which is, "some truth exists" (*aliquam veritatem esse*). However, insofar as it asserts that it itself is true, it does imply that some truth exists [(S2)]. Neither is that remarkable, for just as every evil presupposes good, so this false [statement], "there is no truth" (*nullam veritatem esse*)—since on account of its removal of a predicate from a subject it destroys all truth [(S4)] and on account of its assertion of itself to be true it posits that some truth exists [(S3)]—includes both parts of a contradiction. Therefore, both parts can be inferred from it [(S5)], and it is false in itself and unintelligible by any intellect which rightly apprehends it [(S7)]. And this is what Augustine means to say.[15]

Bonaventure returns to our self-refutation argument before the end of the *De mysterio Trinitatis* (Q. V, art. 1) where his concern is with the Divine Eternity (*Utrum divinum esse sit aeternum*). One of the arguments, (# 5), which he advances in its favor is that truth (which in one of its uses is another name for God) cannot be either thought or said not to be. For if there is no truth, there is some truth. This is so because if no truth exists, it is true that there is no truth or that truth does not exist.[16] Finally, in the *Collationes in Hexaemeron*, written in 1273, speaking of truth, "the light of the soul" (*lux animae*), he once more repeats the Augustinian argument, this time to the effect that if anyone says that there is no truth, he is in fact contradicting himself. For he is saying that it is true that there is no truth.[17]

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[15] "Ad illud quod obiicitur contra rationem Augustini, quod contradictoria non infert suam contradictoriam: dicendum, quod verum est secundum quod contradictoria; sed intelligendum est, quod propositio affirmativa duplicem habet affirmationem: unam, qua asserit praedicatum de subjecto, aliam, qua asserit, se esse veram. In prima distinguitur a propositione negativa, quae removet praedicatum a subjecto; in secunda vero communicat cum illa, quia tam propositio negativa quam affirmativa asserit, se esse veram. Quantum ad primam attenditur contradictio, non quantum ad secundam. Cum vero dicitur: nulla veritas est, haec propositio, in quantum negat praedicatum a subiecto, non infert suam oppositam, quae est, aliquam veritatem esse. In quantum autem asserit, se esse veram, infert aliquam veritatem esse; nec mirum, quia, sicut omne malum praesupponit bonum, sic falsum infert verum. Et ideo hoc falsum, quod est, nullam veritatem esse—cum propter remotionem praedicati a subiecto destruat omne verum, et propter assertionem, qua asserit, se esse veram, ponat, aliquam veritatem esse—includit utramque partem contradictionis; ideo utraque ex illa potest inferri, et ipsum in se esse falsum et inintelligibile ab intellectu recte apprehendente. Et hoc est quod vult dicere Augustinus." *ibid.* ad 5, p. 116. Once more, a close reading of the Latin text here will bring out its grammatical ambiguity.

[16] *Ibid.*, n. 5 *quod sic*, p. 278.

One point worth making here is that Bonaventure's own undoubted spirituality and his almost wanton use of metaphorical language frequently lead to interpretations of him as a mystic, an intuitive rather than analytic thinker, influenced excessively by Pseudo-Dionysius or even Joachim of Fiore, etc. While one may not deny all truth to such interpretations, it is important to realize that they do not express in particular the fact that in these passages we have considered, as well as in others from his work (for example, his treatment of future contingents[18]), Bonaventure displays uncommon logical talent.

III. The Counter Arguments and Replies

4. St. Thomas Aquinas

In his *Summa Theologiae*, St. Thomas Aquinas (1225-1274) has rehearsed the reasoning of St. Augustine within the context of an argument for the self-evident character of the proposition ''God exists''. As Thomas gives it, this argument runs:

> That truth exists is self-evident (*per se notum*) (or the proposition ''Truth exists'' is self-evident). For whoever denies that truth exists (or the proposition, ''Truth exists'') concedes that truth exists (or ''Truth exists''). For if truth does not exist, it true that truth does not exist. But if there is something true, it is necessary that truth does exist. But God is Truth, etc.[19]

Again let us note the complications which arise out of the lack of quotation marks in medieval manuscripts and from Latin indirect discourse. But in particular here let us further remark that St. Thomas' overall concern at this place in his theological *Summa* is first with the proposition ''God exists'', but then through that with the self-evidence attaching to the fact of God's existence.[20]

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[17] *Collationes in Hexaemeron*, coll. 4, n. 1, ed. Amoros, Aperribay, y Oromi, Madrid 1957, III, 254.

[18] On this, cf., e.g., I *Sent.*, d. 38, a. 2, qq. 1-2, *ed. minor*: I, 535-43.

[19] ''Praeterea, veritatem esse est per se notum: quia qui negat veritatem esse, concedit veritatem esse: si enim veritas non est, verum est veritatem non esse. Si autem est aliquid verum, oportet quod veritas sit. Deus autem est ipsa veritas, ...'' *Summa Theologiae* I, 2, 1, ob. 3.

[20] While this may not be immediately apparent from the accusative infinitive construction of the question itself (*Utrum Deum esse sit per se notum*), it becomes evident from St. Thomas' answer to this question, as well as his answer to the question in article 2 (*Utrum Deum esse sit demonstrabile*). In both instances, his first concern is with propositions.

In his reply to the Augustinian argument, St. Thomas is brief. He concedes that truth in general (*in communi*) exists. Or, perhaps more accurately, he concedes that the fact of truth or the proposition "Truth exists" is self-evident, understanding truth in general. Thus, in effect, he concedes the soundness of the basic argument from premise (S1) through conclusion (S8). His objection is with the metaphysical premise (S9); thus he denies that the fact of truth or the self-evidence of the proposition "Truth exists" itself implies the existence of God as First Truth.[21]

St. Thomas has mentioned the argument from the *Soliloquies* in at least one other place. This is in his earlier *Quaestiones de veritate*, where an argument to prove the self-evidence of God's existence (or of the proposition "God exists") is phrased as follows:

> Moreover, God is truth itself. But no one can think that truth does not exist, for if it can not exist then it follows that it does exist. For if truth does not exist, then it is true that truth does not exist. Therefore, no one can think that God does not exist.[22]

To this Thomas has replied:

> To the third [argument] it must be said that truth is founded upon being. Whence just as it is self-evident that being in common exists, so also [it is self-evident] that truth [in common] exists. But it is not self-evident to us that some First Being exists which is the cause of all [other] being, until either faith accepts this or demonstration proves it. Whence, neither is it self-evident that the truth of all [other] things is [derived] from a First Truth; accordingly, it does not follow that God's existence (or the proposition "God exists") is self-evident.[23]

While in the *De Veritate* reply St. Thomas has spelled out his thought in more detail, his reaction to the Augustinian argument is the same as that found in his *Summa*. Thus in both places he accepts the argument to the point that there must be truth, since the denial of truth is self-refuting. What he rejects is that the existence of God as First Truth is thereby established.

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[21] Cf. "Ad tertium dicendum quod veritatem esse in communi, est per se notum: sed primam veritatem esse, hoc non est per se notum quoad nos." *Summa Theol.* I, 2, 1, ad 3.

[22] "Praeterea, Deus est ipsa veritas. Sed nullus potest cogitare veritatem non esse, quia si potest non esse, sequitur eam esse: si enim veritas non est, verum est veritatem non esse. Ergo nullus potest cogitare Deum non esse." *De Veritate*, q. 10, a. 13, ob. 3, ed. Spiazzi, Taurini 1949, 218.

[23] "Ad tertium dicendum, quod veritas supra ens fundatur; unde, sicut ens esse in communi est per se notum, ita etiam veritatem esse. Non autem est per se notum nobis, esse aliquod primum ens quod sit causa omnis entis, quousque hoc vel fides accipiat, vel demonstratio probet; unde nec est per se notum veritatem omnium a veritate prima esse. Unde non sequitur quod Deum esse sit per se notum." *ibid.*, ad 3, 220.

5. Duns Scotus

John Duns Scotus (1266-1308) criticizes the Augustinian argument on two points: first, like St. Thomas, he denies that the existence of God is evident from the existence of truth; but second, unlike St. Thomas, he argues against the necessary prefixability of "it is true" to every statement, specifically, to the statement "There is no truth". Thus he denies that this latter statement is absolutely self-refuting. In effect, then, metaphysical premise (S9) and the modal premise (S1) are under attack. His discussion is found in two different works, each time within the context of asking whether or not the proposition "God exists" is self-evident. First, in his early *Lectura*, we find him giving the following reconstruction of the Augustinian argument:

> It is self-evident that truth exists (*veritatem esse*), therefore, etc. [God exists]. The proof of the antecedent is that anything which follows from its own contradictory is self-evident. But truth is of such a character. For, if you affirm that truth exists, then it is true that you are affirming this, and thus truth exists. [But likewise], if you deny that truth exists, then it is true that truth does not exist. And thus [also], some truth exists.[24]

This, we believe, is the poorest restatement of the Augustinian argument we have to deal with in this article. Scotus has shifted the focus from the statement "There is no truth"—and, thereby, from the question of whether it is *absolutely* self-refuting by virtue of its content alone—to the acts of its affirmation and its denial. This is a gratuitous complication. Furthermore, Scotus turns the self-refutation argument into an obvious non-sequitur when he construes its second premise as the claim that, if one denies that truth exists, it is true that truth does not exist, rather than, if one denies that truth exists, it is true that one denies that truth exists. Fortunately, his subsequent critique of the argument, even in the *Lectura*, does not turn on these difficulties. His criticism in the *Lectura* is this:

> When it is argued that it is self-evident that truth exists, I answer in one way that in the argument there is involved a fallacy of the consequent, arguing from

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[24] "Praeterea, veritatem esse est per se notum, igitur etc. Probatio antecedentis: illud est per se notum quod sequitur ex suo opposito; sed veritas est huiusmodi, quia si affirmas veritatem esse, tunc verum est te hoc affirmare, et ita veritas est; si neges veritatem esse, tunc verum est veritatem non esse. Et ita aliqua veritas est." *Lectura* I, d. 2, p. 1, q. 2, in: *Opera omnia*, ed. Vat. 1960, XVI, 114, n. 10.

> truth in general to this truth, which is God. I answer in another way that [the proposition] "Truth exists" (*veritatem esse*), is not self-evident. And when it is argued that if truth does not exist, it is true that truth does not exist, I say that the consequence is not valid. For truth does not exist except fundamentally in reality or formally in the intellect. But if nothing is true, then nothing exists, and as a result truth is in no thing. Accordingly, it does not follow that if truth (*veritas*) does not exist, therefore this dictum is true, namely, "What is true (*verum*) does not exist".[25]

Some years after, in his *Ordinatio,* Duns Scotus repeats his criticisms.[26] In his reply to the Augustinian argument, he again says that it is not valid to make the inference " 'Truth in general exists' is self-evident (*per se notum*), therefore God exists". There is here a fallacy of the consequent, for the antecedent can be true for some other reason than the existence of God. In this respect, Scotus seemingly agrees with St. Thomas in rejecting metaphysical premise (S9) of the Augustinian argument. But then he goes beyond St. Thomas by again denying that the statement "Truth in general exists" is self-evident from the self-refutation of the denial of all truth. For, when it is claimed—as in the modal premise (S1) of the basic argument—that, if there is no truth, then it is true that there is no truth, the consequence is invalid. In other words, "it is true" is not a necessarily prefixable operator in this case. His reasoning is this: truth ("truth") may be taken in two senses. It can be taken for the foundation of truth in extramental reality (that is, for fundamental truth), or it can be taken for truth in the act of the intellect composing and dividing (that is, for formal truth). But if there is no truth, it is not true that there is either sort of truth, that is, the fundamental truth of reality or the formal truth of the intellect composing and dividing—for there is no intellect. However, what does follow is this: If there is no truth, then it is not true 'there is some truth', -T --> -d'T'. But it does not follow: Therefore it is true that there is not any truth, d'-T'. Rather there is here again a fallacy of the consequent, that is, passing from a negative proposition having two possible causes of its truth to an affirmative proposition about one of those causes.[27]

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[25] "Ad aliud, quando arguitur quod 'veritatem esse est per se notum', dico uno modo quod in argumento est fallacia consequentis, arguendo a veritate in communi ad veritatem 'hanc', quae Deus est; aliter dico quod non est per se nota 'veritatem esse.' Et quando arguitur quod 'si veritas non est, verum est veritatem non esse', dico quod consequentia non valet, quia veritas non est nisi in re fundamentaliter vel in intellectu formaliter; sed si nihil sit verum, tunc nihil est, et per consequens in nullo veritas est. Et ideo non sequitur quod si veritas non est, igitur verum est illud dictum 'verum non esse'." *ibid.*, p. 123, n. 36. Let us note that the internal quotes in this text have been added by the modern editors, displaying their own wrestle with the Latin.

[26] Cf. *Ordinatio* I, d. 2, p. 1, q. 2, n. 12, in: *Obras del Doctor Sutil, Juan Duns Escoto*, Madrid 1950, 371.

As we shall see, Scotus' objections to the modal premise (S1) of the Augustinian argument receive differing reconstructions in the hands of both his followers and critics.

6. *Cajetan*

Two centuries later, Cajetan (1468-1534) takes Duns Scotus to task for his criticism of the first modal premise of the Augustinian argument. In effect, then, Cajetan upheld St. Thomas in his apparent acceptance of the self-evidence of the existence of truth, given the self-refutation of its denial. Cajetan's reconstruction of Scotus picks out two distinct arguments in the latter's objection to the modal premise (S1). Scotus, while admitting it is valid to say that there is no truth, therefore it is not true that there is some truth, -T--> - d‘T’, denies the validity of saying there is no truth, therefore it is true there is no truth, -T --> d‘-T’. The grounds are these:

(i) As Scotus argues, in the first statement, the consequence is negative, -d‘T’, and, thus, it validly follows from the negative antecedent, -T; but in the second, the consequence is affirmative, d‘-T’, and, thus, it does not so follow from the antecedent.[28]

(ii) As Scotus argues, truth is taken either fundamentally or formally. But if there is no truth, then in neither way is it true to say truth remains. Not fundamentally, for no "founding reality" (*res fundans*) remains. And not formally, for no intellect in which such formal truth would reside would be posited as remaining. Accordingly, the affirmative consequent, d'-T', does not follow, but rather only the negative, -d'T'.[29]

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[27] "Ad tertium dico quod 'veritatem in communi esse est per se notum, ergo Deum esse' non sequitur, sed est fallacia consequentis; aliter potest negari maior. Et cum probatur 'si nulla veritas est, nullam veritatem esse verum est', consequentia non valet, quia veritas aut accipitur pro fundamento veritatis in re, aut pro veritate in actu intellectus componente et dividente; sed si nulla veritas est, nec verum est nullam veritatem esse, nec veritate rei, quia nulla res est, nec veritate in intellectu componente et dividente, quia nullus est. Bene tamen sequitur 'si nulla veritas est, ergo non est verum aliquam veritatem esse', sed non sequitur ultra 'ergo verum est aliquam veritatem non esse'; fallacia consequentis, a negativa habente duas causas veritatis ad affirmativam quae est una istarum." *ibid.*, n. 37, pp. 384-5.

[28] Cf. "Scotus tamen, ... reprehendit hanc consequentiam, dicens eam peccare fallacia consequentis, a pluribus causis veritatis ad unam illarum. Tum quia, licet valeat, nulla veritas est, ergo non est verum aliquam veritatem esse; non tamen valet, ergo est verum nullam veritatem esse, illa enim est negativa, ista affirmativa." *In Summam Theologiam* I, q. 2, a. 1, ad 3, no. 9, *ed. Leonina*, Rome 1888, IV, 29.

Cajetan's general reply to Scotus' rejection of the necessary prefixability of the modal operator is this:

> Since it is a matter of good logic that there is the very best consequence from a true proposition of inherence (*vera de inesse*) to a modal proposition of truth (*de vero*) and conversely, because truth is not a mode which adds anything to what lies in front of it (*praejacentem*), it is cause for wonder that anyone could oppose the consequence here. For just as it is valid to say, "Socrates runs, therefore that Socrates runs is true" or similarly, "Socrates does not run, therefore that Socrates does not run is true", so in the instance before us, "There is no truth therefore that there is no truth is true". This is confirmed, for "There is no truth" is a certain proposition (*quaedam enuntiatio*). Therefore, as Aristotle says in the *Perihermeneias* [cf. c. 4], it signifies something true or false. But for those who enunciate it, this proposition signifies what is true; therefore, it signifies: "It is true that there is no truth".[30]

Against objection (i) of Scotus, Cajetan replies that there is here no fallacy of the consequent. For both an affirmative and a negative modal consequent follow. But it is the affirmative, d'-T', which follows *immediately* and the negative, -d'T', which follows *mediately*. The idea is this: the affirmative modal consequent hinges only upon (*pertinet ad*) the consistency of the proposition in itself. However, the negative modal consequent hinges upon the negation of the contradictory opposite of the proposition in question. Now although the negation of the contradictory opposite of a proposition follows immediately (*statim*), the negation of that contradictory's corresponding modal formulation follows only in virtue of the rule that any proposition of inherence is equivalent to a modal proposition of truth. So it is that the proposition "There is no truth" only mediately implies the negative modal "It is not true 'there is some truth' ". From this,

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[29] *Ibid.*

[30] "Ad hoc breviter dicitur quod, cum secundum bonam logicam, a propositione vera *de inesse* ad suam modalem *de vero*, sit optima consequentia, et e converso, quia verum non est modus addens supra suam praeiacentem: miror quomodo arguens huic consequentiae se opposuit. Valet namque, *Socrates currit, ergo Socratem currere est verum*: et similiter, *Socrates non currit, ergo Socratem non currere est verum*: et patet in omnibus. Et sic in proposito, *nulla veritas est: ergo nullam veritatem esse est verum.*—Et confirmatur: quia ista, scilicet *nulla veritas est*, est quaedam enuntiatio: ergo significans verum vel falsum, ex *Periherm.* Sed apud eos significat verum: ergo significat nullam veritatem esse, esse verum." *ibid.*, n. 10. For this rule of "good logic", cf. St. Bonaventure, I *Sent.* d. 8, p. 1, a. 1, q. 2, arg. e, *ed. minor* I, 119; St. Thomas, *De propositionibus modalibus*, n. 1, ed. Perrier, Paris 1949, 461; also see: John of St. Thomas, *Logica*, I P., L. II, c. 20, ed. Reiser, Taurini 1930, I, 48.

Cajetan reasons, Scotus even as he denied the consequence unwittingly conceded it as he conceded another founded upon it.[31]

Against objection (ii) of Scotus, Cajetan replies that truth is taken here at least fundamentally and that, when Scotus says that no foundation remains, this is to be denied. For it seems clear that in order that there be an abiding foundation for negative truths, it is not necessary that any thing remain. Hence the truth of this proposition "Nothing is nothing" fundamentally remains, even in the absence of every thing and intellect. This is because, if there would be an intellect, it could "adequate objectively" (*adaequare objectaliter*) its own act of composition to that condition, by composing the proposition "Nothing is nothing", and this kind of "remaining" (*remansio*) is enough. Hence, even now, this proposition "Nothing is nothing" has a foundation on the side of the thing signified only in this way (*modo dicto*). But when it is said that truth fundamentally is being (*entitas*), this is true of positive truth, not however of negative truth. For the foundation of negative truth is not being but *non-being.*[32]

Cajetan's theory of negative truths invites comparisons with Bertrand Russell's theory of "negative facts" first advanced in the third of his 1918 lectures on Logical Atomism. Assuming a correspondence theory of truth, Russell argued that if some proposition 'p' is false (equivalently, proposition '-p' is true), then it can only be so if the corresponding fact which makes it false (or true) is a negative fact:

> Are there negative facts? Are there such facts as you might call the fact that 'Socrates is not alive'? I have assumed in all that I have said hitherto that there are negative facts, that for example if you say "Socrates is alive" there is corresponding to that proposition in the real world the fact that Socrates is not alive.[33]

Cajetan and Russell would seem to be of one mind on the issue of the explanation of negative truths and of falsity.

7. Francis Lychetus

What Cajetan had been to St. Thomas, Francis Lychetus (d. 1520) was to Duns Scotus. That is to say, he was the best known commentator on the chief work of Scotus, the *Ordinatio*.[34] Not surprisingly, then, in the course of his commentary Lychetus considered the Augustinian argument, defending Scotus against the attacks of Cajetan.

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[31] Cf. "Et sic Scotus, negando consequentiam, concessit illam nesciens, dum concessit aliam super radice illius fundatam." *In Summam*, I, 2, 1, ad 3, n. 11.

[32] *Ibid.*

[33] B. Russell, *The Philosophy of Logical Atomism*, in: *Logic and Knowledge: Essays 1902-1950*, ed. R.C. Marsh, London 1956, 211.

Lychetus, in effect, rehearses with approval Duns Scotus' objection to the metaphysical premise (S9) of the Augustinian argument: from the statement "There is no truth", it follows only that truth in general exists and not that the particular truth which is God exists. To think otherwise would involve the fallacy of the consequent and would be an argument not dissimilar to one which ran: "An animal exists, therefore a man exists."[35]

However, in regard to Scotus' rejection of the modal premise (S1) of the Augustinian argument, Lychetus supplements Scotus' objections with another: he affirms it as "a rule of insolubles" (*una regula insolubilium*) that *when there is some proposition which includes contradictories, it is to be denied in every instance*, for only possible instances should be allowed.[36] Put schematically: $p \dashrightarrow (q \,\&\, - q) \vdash - p$. Thus from a proposition of inherence (*de inesse*) which implies incompossible things, it is invalid to infer the modality of truth (*de vero*) of that proposition, contrary to the claim of Bonaventure that every proposition has a twofold affirmation: one of inherence by which it asserts a predicate of a subject, and one of modality by which it asserts itself to be true. But such an invalid inference is involved in the case at hand, when it is said, "there is no truth, therefore it is true 'there is no truth' ", for this proposition of inherence implies a contradiction and, thus, it does not imply the modal proposition that it itself is true. The implied contradiction is this: On the one hand, if there is no truth then neither is it itself true, -T --> - -T. On the other hand, if it is true that there is no truth, then it itself is true, because it signifies that the fact is such as it is, - T --> -T. Accordingly, it is itself both true and not true at the same time, - T --> (- -T & -T).[37]

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[34] On Lychetus, cf. E. Gilson [*History of Christian Philosophy in the Middle Ages*, New York 1955, 300, n. 77]: "The Commentary of Lychetus on the *Opus Oxoniense* is an excellent guide to the study of Scotism."

[35] "Prima responsio talis est, quia non sequitur veritatem esse in communi est per se notum; ergo Deum esse per se notum. Committitur fallacia consequentis, a positione consequentis ad positionem antecedentis, ac si argueret: *Animal est, ergo homo est*; ..." Lychetus, *In Quaestiones J.D. Scoti in primam Sententiarum*, I, d. 2, q. 2, ed. Wadding, Paris 1893, VIII, 413, n. 21.

[36] "Et nota, quod est una regula insolubilium: *Quando est aliqua propositio includens contradictoria, ipsa est neganda in omni casu*, quia solum casus possibilis debet admitti." *Ibid.* (Let us remark here the cardinal number, "*una*", used as an indefinite article). On this rule, cf. D. Soto: "Nihilominus opinio communis est, quod nulla sit propositio, quae non sit vera vel falsa, postquam illa est definitio propositionis, scilicet quae vere vel false significat. Et ideo dicunt quod propositio asserens se esse falsam, est falsa." *Summulae*, V. C. 9, ed. 2a, Salmanticae 1554, 152v. Soto himself in the continuation of his text will not go along with this "common opinion". For the rule in earlier use, cf. J. Buridan, *Sophismata*, c. 8, n. 7, tr. Scott, 191-6.

Reenforcing Scotus' claim that an inference from - T to d'-T' involves the fallacy of the consequent, Lychetus accuses Cajetan of failing to argue to the point against Scotus.[38] Admittedly, when an argument is constructed from a *true* proposition of inherence to one with the modality of truth, the consequence is quite good. For example, "Socrates runs, therefore it is true that Socrates runs". But in the case in point: "There is no truth, therefore it is true that there is no truth"—it is clear that Cajetan did not understand Duns Scotus. For, as is shown by the text of Scotus, an argument is not being made from a *true* proposition of inherence: that is to say, "There is no truth" is not true.[39] In general, accuses Lychetus, whatever Cajetan has to say on this matter proceeds from a misunderstanding of Scotus.[40]

In an attempt to correct a growing misunderstanding of Scotus' fundamental argument as it is found in the *Ordinatio,*[41] Lychetus provides a summary restatement: The causes of the truth of the claim that there is no truth, -T, could be two, namely, that it is not true that some truth exists, -d'T', or it is true that some truth does not exist, d'- T'. Of these, the first is negative, the second affirmative. Given, then, that there is no truth, -T, it would follow that no truth exists, neither in reality nor in the intellect, and, thus, also follows the negative, it is not true that some truth exists, -d'T'; but, it would not follow that no truth exists, and, thus, also follows the affirmative, it is true that some truth does not exist, d'-T'. In this latter case, there would be an argument from a proposition which has two possible causes of its truth one negative and one affirmative to only one, the affirmative, and hence a fallacy of the consequent.[42]

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[37] Cf. "... et sic ista propositio: *Nulla veritas est*, falsificat seipsam, quia si nulla veritas est, tunc nec ipsa est vera, et si verum est quod nulla veritas sit, tunc ipsa est vera, quia significat ita esse sicut est; ergo ipsa est vera et non vera simul." Lychetus, *In Quaestiones J.D. Scoti* ..., I, d. 2, q. 2, ed. Wadding, VIII, 413, n. 21.

[38] Cf. "... ille novus expositor Sancti Thomae non arguit ad propositum contra Doctorem, cum dicit quod hic non committitur fallacia consequentis, ..." *ibid.*, n. 22.

[39] Cf. "... quia quando arguitur a propositione vera de *inesse* ad suam modalem de *vero*, est optima consequentia, quia bene sequitur: *Socrates currit; ergo Socratem currere est verum.* Sic in proposito, nulla veritas est; ergo nullam veritatem esse, est verum; patet quod non intelligit Doctorem, quia hic non arguitur a propositione vera de *inesse*, ut patet in littera Doctoris." *ibid.*

[40] Cf. "Et sequentia, quae dicit iste expositor, procedunt ex malo intellectu eorum quae hic dicuntur." *ibid.*

[41] *Ibid.*, 413-4.

8. *Francis Toletus*

One of the first Jesuit philosopher-theologians of note, Francis Toletus (1533-1596), has left us a readable and thoughtful commentary on the *Summa Theologiae* of St. Thomas, in the course of which he has taken up this question of the self-evidence of truth. Toletus' own position is a defense of Aquinas against Scotus, but he is dissatisfied with Cajetan's earlier attempt to do the same.

Toletus provides the clearest reconstruction of Scotus' arguments against the modal premise of the Augustinian argument. In respect to the denial of all truth, Scotus only admits the validity of the negative inference "There is no truth, therefore it is not true 'there is some truth' ", "-T --> -d'T' ".[43] Scotus, as Toletus understands him, had advanced three arguments against the modal premise "There is no truth, therefore it is true 'there is no truth' ", "-T --> d'-T' ".

(i) Scotus argues that the consequence of the modal premise involves the fallacy of the consequent inasmuch as it passes from a more universal to a less universal conclusion (*a superiori ad inferius*), for it proceeds from a proposition having more than one cause of its truth to just one of these causes. To elaborate: that proposition is said to have several causes of its truth which can be true in a number of ways. Thus, the proposition "An animal runs" becomes true if a lion runs, if a man runs, or if any other animal runs. Accordingly, if someone were to argue "an animal runs, therefore a man runs", this argument would not be valid. Similarly, this proposition, "There is no truth", can be true for two reasons: either because of this modal proposition, "It is true 'there is no truth' " or because the fact is such as this proposition signifies. To argue from this to one reason only is fallacious.[44]

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[42] Cf. "Vel dicatur et melius, quod causae veritatis istius, scilicet *nulla veritas est*, sunt istae, *scilicet non est verum, aliquam veritatem esse*, vel *est verum, aliquam veritatem non esse*, et haec secunda est affirmativa. Licet ergo sequatur nulla veritas est, nec in re, nec in intellectu; ergo non est verum aliquam veritatem esse, sed post non sequitur: *Ergo est verum, aliquam veritatem non esse*, arguitur enim a propositione habente duas causas ad affirmativam illarum." *ibid.* 414.

[43] Cf. "Perinde est, ac si dicat Scotus: si aliquis omnem veritatem negaret, tunc ista propositio esset falsa, nulla est veritas; et non vera, ut dicit S. Thomas." Francisci Toleti, *In Summam theologiae S. Thomae Aquinatis*, I, 2, 1, and 3, Romae 1869, I, 58.

(ii) Scotus argues that from a negative premise no valid affirmative conclusion follows. But the proposition "There is no truth" is negative, while the proposition "It is true 'there is no truth' " is affirmative.[45]

(iii) Finally, Scotus argues to this effect: if the proposition "There is no truth" is true, it is true by either a fundamental or a formal truth; but neither of these is possible. By fundamental truth is meant an extramental thing which exists in the way it is signified. Formal truth, however, is in the concept or the word (*in conceptu vel voce*)[46] when it signifies something as it exists. But by neither of these can the proposition in question be true. For whoever says that there is no truth, denies or takes away everything in extramental reality and thus he takes away everything. Hence fundamental truth does not remain. Further, when he takes away everything, he takes away the intellect itself. Thus, formal truth also does not remain. Accordingly, the proposition in question is not true.[47]

In the attempt to understand Toletus' response to Scotus' objections, it is well to make some distinctions in respect of the interpretation of the denial of truth, -T. As Toletus recognizes, Scotus' objections interpreted in one way are compelling; interpreted differently, they are not. Two interpretative questions are to be distinguished:

(I) Is -T to be taken as a denial of fundamental truth, or only formal truth?

(II) If the latter, is -T to be taken as self-referring or not?

As regards question (I), Toletus would have no objection to saying that if -T is taken as a denial of all truth, both fundamental and formal, then Scotus is correct in saying that d'-T' is not a consequence of -T, for the very reason Scotus gives; namely, if there is no truth, then everything is taken away, including, this proposition, and hence it would not follow that it would be true that there is no truth, if there were no truth.[48]

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[44] Cf. *ibid.*, 58-9.

[45] *Ibid.*, 59.

[46] Strictly speaking, Duns Scotus has said that truth formally is in the intellect "composing and dividing" (cf. note 27, above) that is to say, in the judgment rather than in the concept or much less in the word. This is just looseness of expression on Toletus' part and not a change of doctrine.

[47] Toletus, *loc. cit.*, 59.

[48] *Ibid.*

Furthermore, Toletus will not accept Cajetan's attempt to save the modal premise by the introduction of the theory of non-entity as a foundation of negative formal truth. With nothing existing there would not be any fundamental truth, since there would be nothing. Here he rejects Cajetan's differentiation between the conditions of negative and affirmative truth. As Toletus sees it, there is no fundamental negative truth without formal truth, even though there is fundamental affirmative truth without formal truth.[49] Hence, there is no negative truth, unless one posits a thought or a proposition, for example, expressing: "That (*illud*) [i.e. some item under discussion] does not exist." But if Cajetan posits some proposition or thought, with that he is positing some formal truth. And yet he is not positing it, for granted that nothing would exist except this proposition, "Nothing exists" or "There is no truth", then it would be false because it falsifies itself. For if the fact is such as it says it is—that it itself does not exist—it is also the fact that it is not true.[50]

On the other hand, if as regards question (I) the antecedent of the modal premise is construed as referring only to formal, and not fundamental, truth, then Scotus' objection (iii) has no force. As Toletus would have us interpret him, St. Thomas is speaking not about fundamental, but rather *formal* truth when he says, in effect, that -T implies that d'-T'. That is, one would in some way say something true who would say this proposition, "There is no truth", if in fact there were no formal truth. For this reason, it would be valid to say, "Therefore it is true that truth does not exist". For in so far as the fact would be as the proposition says, there would seem to be some truth in this proposition. However, absolutely (*absolute*), one must say that this proposition, "-T", is not true.[51]

[49] Cf. "Primo si Dominus Caietanus velit, quod nulla exsistente re tunc est veritas fundamentalis, nos non admittimus; quum enim nihil sit, non erit veritas. Quod si recurrat ad differentiam inter affirmationem et negationem, profecto eodem recursu non admitto suam doctrinam; nam veritas negativa in hoc ab affirmativa differt, quod non est fundamentalis negativa sine formali, affirmativa autem sic." *ibid.*

[50] Cf. "Unde nisi det conceptum vel propositionem exprimentem illud non esse, nulla est veritas negativa. Quod si ponat propositionem aliquam vel conceptum, iam ponit formalem veritatem: immo nec hanc ponit; quia dato quod nihil esset nisi ista propositio, nihil est, vel nulla est veritas; tunc esset falsa, quia se falsificat. Si enim ita est, ut per ipsam dicitur, quod ipsa non est; et sic non est vera." *ibid.*

[51] Cf. "Dico ergo pro S. Thoma, quod loquitur de veritate formali, quae est in propositione; et quod in illo casu, nulla est veritas, aliquo modo diceret verum, qui ita diceret, si nulla esset: ob id valet, ergo verum est veritatem non esse. Quatenus enim ita est, sicut dicit, aliquid veri videtur inesse: tamen absolute dicendum est, quod non esset vera." *ibid.*

As regards question (II)—whether "-T" is self-referring—Toletus recognizes that if it be so taken, then (again) Scotus is correct in rejecting the modal premise. Toletus' thinking is this: Just as logicians have shown that the reflexive proposition "This proposition is false" must be false,[52] so the proposition "There is no truth", when taken reflexively, must be false.[53] Hence, Scotus rightly said it does not follow " 'There is no truth' is true", if there is no truth. Accordingly, it does not immediately follow that a proposition is true because the fact is such as it signifies—as the logicians point out with regard to certain reflexive propositions.[54]

On the other hand, the force of Scotus' objection can be avoided, provided "-T" is construed as a non-reflexive proposition. It is to be noted that Toletus is not taking the line of Ockham that no proposition is self-referring.[55] The evident understanding of what Toletus is saying is that propositions can be used non-reflexively, and in this case, St. Thomas did not intend that this proposition "- T" in the modal premise have reflexion back upon itself.[56] And as a non-reflexive proposition, "- T" does imply "d'-T' ".

In raising the question of reflexivity, Toletus links himself with the logicians of the day who were grappling with problems of self-reference. However it is well to remember the distinction we have noted in Section I above, that between merely self-refuting and truly paradoxical self-reference. Our theologians are working only with the former; Buridan and other logicians are primarily concerned with the latter, the so-called "insolubles" (*insolubilia*) which (apparently) lead to a vicious circle: admission of their truth implies their falsity; admission of their falsity implies (or seems to imply) their truth. As Buridan's account makes clear, our statement, "There is no truth" (or its equivalent "Every sentence is false"), suggests this paradoxical circle only if one accepts certain restrictive assumptions: (a) that the truth-denying sentence concerns only formal (sentential) truth, (b) that all true sentences should be destroyed and only false ones remain, and (c) that the only sentence subsequently uttered is "There is no truth" (or "Every sentence is false"). On these assumptions, one faces this circle of inference: if the last uttered sentence is true, then there is no truth, and, so, it is false, since this sentence is true; on the other hand, if it is false, then no sentence is true, and hence it is true. Buridan, as we have noted, claims to resolve this sort of paradox by claiming that the circle is only apparent, since the falsity of the sentence in question does not, in fact, imply its own truth, although its truth implies is falsity, and hence it is false.[57]

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[52] For this, see, e.g., John of St. Thomas, *Logica*, I P., L. II, c. 6, ed. Reiser I, 24-5; or earlier: J. Buridan, *Tractatus de consequentiis*, I, c. 5, ed. Hubien, 26.

[53] Cf. "Sicut dicunt logici de ista propositione, haec est falsa, quae se ipsam demonstret; omnes enim tunc falsam proclamant, nec est logicus, qui oppositum dicat: ita de illa, nulla est veritas." Toletus, *loc. cit.*, 59-60; cf. J. Buridan, *Tractatus* ..., I, cc. 1 and 5, pp. 17 and 26.

[54] Cf. "Unde bene dixit Scotus illam non sequi, verum est nullam veritatem esse: non enim quia ita est, sicut propositio significat, statim sequitur quod sit vera, ut docent omnes logici in propositionibus reflexivis." *ibid.*, 60.

[55] For Ockham, cf. *Summa Logicae* III, 3, c. 45, as given by E.A. Moody, *Truth and Consequence in Mediaeval Logic*, Amsterdam 1953, 103. For Buridan's opposition, cf. *ibid.*; and *Sophismata*, VIII, n. 7, tr. Scott, 192.

[56] Cf. "Potest hoc etiam dici, quod vera est etiam illa propositio, quia negat alia, quae extra se sunt, et non se. Et in hoc sensu puto S. Thomam intellexisse: non enim voluit illam reflexionem super ipsammet propositionem considerare." Toletus, *loc. cit.*, 60.

But, of course, our theologians have no need for, nor interest in, making such restrictive assumptions in respect of the statement "There is no truth." Their concern is not with the logic of paradox, but with a statement alleged to be self-refuting and, accordingly, implicative of the absolute truth of its contradictory, "There is truth".

IV. Closing Remark

At the beginning of this article, the point was made that those who would be considered in it were not working simply in logic. Their principle concern was metaphysical or theological. Indeed, Toletus at the end of his discussion of our issue says as much.[58]

At the same time, these theologians were aware of logical issues involved in this problem of self-refuting self-reference. It would be an absurd claim to say that they were as sophisticated about this as modern logicians have come to be. Even apart from symbolization, modern logicians have all sorts of tools available to them which our theologians did not have. These would include well developed (i.e., beyond considerations of "first" and "second intentions") notions of language hierarchies, clear distinctions (at least for some) between sentences and propositions, the explicit differentiation of sentence types and sentence tokens, the "use-mention" distinction, and the like. Our theologians were *de facto*, if not *de jure*, kept from an easy familiarity with such points by the grammatical conventions of their Latin as well as by their writing practices.

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[57] Buridan, *Sophismata*, VIII, n. 7, tr. Scott, 191-6. Cf. C.I. Lewis & C.H. Langford, *Symbolic Logic*, 2nd ed., New York 1932, ch. XIII, 438ff.

[58] Cf. "Sufficiant ista de rebus logicis, quia logicum non agimus, sed theologum." *loc. cit.*, 60.

But, also in comparison with such medieval logicians as Ockham and Buridan, our theologians appear rather simple. Thus, albeit we can praise the logical prowess of a St. Bonaventure, we must admit that he has little intimation of the semantic and syntactic nuances which will come in later medieval terminist theory. Moreover, even in the instance of later figures such as Cajetan and Toletus, who demonstrate deep appreciation of the problem of the foundation of negative truth and of different uses of propositions, the treatment of our apparently self-refuting statement is, when compared to, say, Buridan's treatment of "*insolubilia*",[59] elementary—and at least in the case of Toletus, we believe, slanting toward eclecticism.[60] And yet, primitive though they might have been, their discussion lets us enjoy the strokes of more than one philosophical Grandma Moses. While their thoughts can never hang in a museum, we think they do deserve a place in the history of philosophy.

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[59] For this see the works of Scott and Hughes cited above.

[60] What is hinted at in Toletus is much more obvious in the semi-nominalistic treatment of *insolubilia* found in the Thomist, Domingo Soto, *op. cit.*, V, c. 9, fol. 151v-155r.

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Reviews

Desmond Paul Henry, *Medieval Mereology*, Amsterdam-Philadelphia (B.R. Grüner) 1991, XXV + 609 pp. ISBN 90 6032 318 1 (Bochumer Studien zur Philosophie, hrsg. von K. Flasch, R. Imbach, B. Mojsisch, O. Pluta, Band 16)

The second word in the title of the present book refers to the theory concerning parts and wholes in the concrete sense that was developed by the Polish logician Stanislaw Lesniewski and elaborated by his pupil Czeslaw Lejewski, who was Mr. Henry's colleague at the University of Manchester. For the benefit of those readers who want to delve somewhat further into the systematic mereology that is the source of inspiration and the background for the actual content of the book the author provides a clear survey of essentials in Chapter 10 (pp. 541-591). Although studying this appendix will certainly be helpful, it is not necessary for understanding the historical doctrines, since throughout the work technical matters are lucidly and informally explained as they come up. As the first word in the title indicates, the book is about the varied fortunes of views on the part-whole relationship during the Middle Ages. Though the author frequently expresses his regret that he has been unable to do full justice to the richness of the sources, he has admirably succeeded in making available an anthology of representative texts that will convince every reader of the importance which mereological themes had for medieval thinkers. The numerous texts that are paraphrased and commented upon are also given in the original Latin, so that the interpretations can be checked right away.

After some preliminaries and an exposition of Boethius' doctrine in the *De divisione* a lengthy chapter (pp. 64-217) is devoted to Abelard and his contemporaries Joscelin of Soissons and Gilbert of Poitiers. A curious point on which special light is thrown in this mereological context is Roscellin of Compiègne's letter in which he cruelly suggests that Abelard, having been deprived of that part which constitutes him a man, is no longer to be called *Petrus* but rather *imperfectus Petrus.* In Chapter 3 (pp. 218-328) the author discusses several mereological aspects of Thomas Aquinas' writings, thereby adding to the immense literature a new fertile angle from which this philosopher can be studied. Then, after a brief elucidation of some Buridanian theses, follows Chapter 5 (pp. 341-382) in which some subjects belonging to the doctrine of fallacies are dealt with, among them the fallacy of *secundum quid et simpliciter* and the Liar Paradox. The latter has a mereological facet in that such an isolated utterance as *This sentence is false* prompts the question whether a term occurring in some stretch of speech can stand for the whole of which it is a part, and hence whether it can in that sense be self-referent. As is made clear in Chapter 6 (pp. 383-405), a rather deviant type of mereology was defended by John Wyclif in the second half of the fourteenth century. The most interesting feature of his doctrine is the thesis that the integral whole of men is a man: all men collectively are one person, and that aggregate person is not any one of its integral parts but is an aggregate formed from all of them, and this is truly an individual substance of a rational nature, a *homo magnus, qui est totum genus humanum.* Next, Chapter 7 (pp. 406-461) brings together the notions of whole and part and the distinction between categorematic and syncategorematic signs. The sentence *Totus Sortes est minor Sorte*, for example, was considered to be ambiguous between a categorematic and a syncategorematic reading. Taken in a categorematic sense, the sentence is false, since the complete Socrates made up from all his parts is not less than Socrates. On the other hand, if the words are taken in a syncategorematic sense, the sentence is true, for then what is conveyed is that any part of Socrates is less than the whole Socrates. Finally, in Chapter 8 (pp. 462-537), called Venetian Harvest,

Treatise 14 of Part I of Paul of Venice's *Logica magna (De toto categorematice tento)* is edited, translated and elucidated by means of notes and comments.

The book, which also contains a bibliography and an index, is a most welcome specimen of a genre of investigations that is urgently needed in the historiography of logic and philosophy of language: articles or monographs on the vicissitudes of certain specialized semantic fields, dealing with the technical terms, the relations between those terms, and the relevant distinctions belonging to some coherent domain. For one important section of philosophical vocabulary Henry has written an impressive overview that is a truly illuminating mine of reliable information for anyone who wants to know more about conceptions of the part-whole relationship in the Middle Ages and in a long stretch of post-medieval philosophy.

Leiden GABRIEL NUCHELMANS

O. Weijers, *Dictionnaires et répertoires au moyen âge*, Turnhout (Brepols) 1991, 212 pp. ISBN 2 503 37004 7 (CIVICIMA, 4)

Vorliegende Untersuchung wirft Licht auf einen bisher größtenteils vernachlässigten Gegenstand der Mediävistik, auf die Arbeitsmethoden und -techniken der mittellateinischen Lexikographie. Unter Verwendung einer beträchtlichen Anzahl mittellateinischer Glossarien, *derivationes* und Diktionäre, u.a. des *Glossarium Ansileubi*, der Werke des Papias, Osbern von Gloucester, Hugucio von Pisa und des Johannes Balbi (um nur die wichtigsten zu nennen), führt Verf. aus, welches die Methoden der Alphabethisierung, des Verweisens und Zitierens, der Materialsammlung, der Worterklärung etc. waren. Neben den Glossarien, *derivationes* und Diktionären setzt sich Verf. mit angrenzenden mittellateinischen Systematisierungsversuchen auseinander, mit Repertorien, juristischen *distinctiones*, juristischen Konkordanzen, Bibliothekskatalogen und Bibliographien. Aus jeder Seite von Weijers' Studie geht hervor, wie sehr sich die mittelalterlichen Lexika von modernen unterscheiden. Kaum etwas darf hier als selbstverständlich betrachtet werden, nicht einmal die durchgehende Alphabethisierung (s. S. 14-23), die erst im 13. Jahrhundert von Guillelmus Brito und Johannes Balbi eingeführt, aber auch dann nicht als einzige Methode verwendet wurde. Eine wichtige alternative Ordnungsmethode war die der *derivationes*, d.h. der Zusammenfügung aller Wörter, die auf ein bestimmtes *verbum simplex* zurückgehen. Es ist ein großer Gewinn, daß das mittellateinische lexikographische Schrifttum, eine Materialgruppe, aus welcher bisher vor allem inhaltlich geschöpft wurde, jetzt auch auf die ihm zugrundeliegenden Methoden hin untersucht wurde. Vorliegende Arbeit zeichnet sich durch eine transparente, systematische Präsentationsweise, durch profunde Materialkenntnis und durch eine gute Dokumentation aus. Besonders nützlich ist die Liste mittellateinischer lexikographischer Werke (einschließlich der Repertorien, *distinctiones* etc.), die die Verf. in einem bibliographischen Anhang (S. 180-206) anbietet. Vorliegende Monographie wird eine Pflichtlektüre für jeden Mediävisten bilden, der in irgendeiner Weise mit mittellateinischen Systematisierungsversuchen in Berührung kommt — und diese Einschränkung wird wohl nur weinige Mediävisten ausklammern.

Leiden KARL A.E. ENENKEL

Eco, Umberto & Marmo, Costantino (eds.), *On the Medieval Theory of Signs* (= Foundation of Semiotics 21), Amsterdam/Philadelphia (John Benjamins) 1989, ix + 224 pp. ISBN 90 272 3293 8 (hardback). 9027221081 (paperback); 1556190751 (USA, paperback).[1]

This book consists of six papers by a remarkable group of young Bolognese scholars—Roberto Lambertini, Andrea Tabarroni, Roberto Pellerey and the co-editor Costantino Marmo—who attended a seminar given by Eco in 1982/3, plus a paper by the master himself. All papers were first written in Italian and most of them published in that language in 1984. The original language interferes too much with the English, but rarely so much as to make reading really difficult.

The book is divided into two sections. Section 1 is dominated by the master, section 2 by the apprentices.

Though there are excursions into other periods of history, the years 1260-1325 receive the lion's share of attention, with special focus on Roger Bacon, Thomas Aquinas, Duns Scotus and William of Ockham. Bacon easily acquires the hero's role in a semiotician's account of history, and in this volume he receives perhaps more than his due share of glory. He was, after all, an outsider of sorts. At the present stage of knowledge it appears dangerous to treat him as if he were just another important medieval thinker with the same chance as more conformist people to influence doctrinal developments.

Section one consists of two papers. The first, co-authored by Eco, Lambertini, Marmo and Tabarroni, deals with animal language. It is interesting in concentrating on a marginal theme in ancient and medieval discussions of signification. Is a dog's bark a phenomenon of the same semiotic status as a man's groans of pain? Or where does it belong in a classification of sounds or of signs? Though the paper ranges over some 1,500 years, from Aristotle to Aquinas, its textual basis is rather narrow, and the reader is left to wonder about the evidence for some claims, as for instance that Roger Bacon read *Peri hermeneias* ch. 1 in Greek and recognized the difference between σύμβολα and σημεῖα (claim repeated in Paper N° 2). Yet the paper is valuable for drawing attention to a cluster of problems which, though marginal, ought to be solved by any theory of signification.

The next article, by Eco, is called 'Denotation'. It is an attempt to trace the semantic development of 'denotare' and its derivatives in order to elucidate the background of 19th-and 20th-century use of this family of words. Once again, we are taken through many centuries; and once again the textual basis is too narrow. Thus, Ockham's use of the locution 'per istam propositionem denotatur quod ....' (e.g. "per istam 'Sortes est albus' denotatur quod Sortes est illa res, quae habet albedinem") is examined as if it were a novelty with Ockham though one can find any number of authors from the preceding century employing it.

The papers in section 2 try to do less but achieve more than those of section 1. Not that their aims are quite modest, though. Pellerey undertakes to explain Thomas Aquinas' thoughts on "natural semiotics and the epistemological process"; Marmo "ontology and semantics in the logic of Duns Scotus"; and Tabarroni "mental signs and representation in Ockham". Vast and difficult subjects as treated by three great thinkers.

Pellerey's contribution is noticeable not least for its laudable attempt to spell out Thomas' statement about cognitive processes not only in other words but also by producing flow-charts. The meticulous charting of the role of phantasms, sensible species etc. then issues in a grand and provocative conclusion to the effect that in the semiotics of Thomas "The signification of reality is a natural relation, communication is a necessary, mechanical act of knowledge, the code is reality itself."

Marmo's paper on Scotus moves over ground that many have studied but not down

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well-trodden paths. It is refreshing by taking advantage of recent progress in the study of 13th-century logic. Thus he compares Scotus' definition of simple supposition with those of William of Sherwood, Peter of Spain and Lambert of Auxerre to see whether Scotus is closer to the continental or to the British tradition. The latter turns out to be the case, at least if we take Sherwood as a representative of the insular tradition. Marmo in his conclusion describes Scotus' semantics as a synthesis of the French and the British tradition,—a synthesis with certain extensionalist features but whose isolation of a distinct sphere of meanings (formalities) allowed him to overcome some of the problems that beset extensionalism while introducing its own because of the "ambiguous ontological status of the contracting difference" (i.e. the hæcceity) "halfway between formalities and individuals."

Tabarroni sees a development in Ockham's conception of mental language, a development that makes it propositional: its signs are "determined only by their reference to an object and by the way in which they replace it in a mental proposition"—any claim that the significative function of a mental term is mediated by a relation of similarity, causality or the like has to be dropped. This is the consequence of extending the status of natural signs from mental categorematic terms to syncategorematic ones, which Ockham seems to perform at the same time as abandoning the *fictum*-theory.

Lambertini's paper on "Direction in contemporary interpretations of the Modistae" ostensibly has a more modest aim than the others. He reviews and criticizes modern interpretations of modist theory, especially such as squeeze it into modern moulds that it does not fit. The oft maltreated *modi significandi* are for once subjected to sympathetic treatment. It could be considered basking open doors to refute Enders' interpretation, but Lambertini manages to make the refutation interesting, though not as interesting as his discussion of scholars who see the medieval theory with Chomskian eyes. They make too much of the modist claim that grammar is universal. On the other hand, Lambertini does not quite do justice to the abilities of some medievals to disregard Latin peculiarities. They did not spell out transformational rules to take us from the depths to surface. But they did think that the same *modi significandi* could be expressed in quite different ways—through separate lexical items or through inflection, for instance. Thus Boethius of Dacia explains the fact that Greek has articles and Latin not by the assumption that Greek nouns and verbs do not inflect for gender, case, number and person, the function of distinguishing between such modi significandi (singular from plural etc.) being carried by special words, the articles, instead of being done by inflection of the nouns and verbs themselves[2]. Lambertini correctly points out that the modists do not appeal to innatism to explain why all men employ the same grammar, only accidentally diversified; modists appeal to the fact that we do not each have our own reality. But would all think that reality just imposes itself upon us, or wouldn't some add that not one but two conditions are satisfied, viz. that reality does not change according to observer, and that all human observers have an innate propensity to grasp it in the one true way?

Though cast in the modest form of a *Forschungsbericht*, this paper is no less provocative than its companions.

Copenhagen — STEN EBBESEN

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[1] It was the reviewer's intention that this review be placed between the reviews of J. Magee and Brams published in vol. 29 (2). Inadvertently, these reviews were separated by the editor. As a result of this error a reference to the Bolognese scholars (29/2, p. 154) has been left hanging in the air. Furthermore, we would like to correct a misunderstanding in the corrections in the proofs on pp. 150-1 of that issue: the non-

sensical word "prootoo" appeared instead of the intended "prootoon". The editor offers his apologies for these inconveniences.
[2] Boethius de Dacia, *Modi Significandi* (CPhD 4) qu. 114; Johannes Dacus, *Summa Grammatica* (CPhD 1) 55

Azucena Adelina Fraboschi, *Cronica de la Universidad de Paris y de una huelga y sus motivos (1200-1231)*, Buenos Aires (Instituto de Estudios Grecolatinos "Prof. F. Nóvoa") 1991, 143 pp. ISBN 950 99820 0 8.

Fraboschi's work is primarily a study of university sermons delivered at the time of the great strike at the University of Paris, 1229-1231. In order to place that material in context, the author begins her work with an overview of the development of the university in the early thirteenth century, its institutional organization, and the events leading up to the strike called in March 1229. This first section included numerous Spanish translations of documents published in the *Chartularium Universitatis Parisiensis*, edited by H. Denifle and E. Chatelain at the end of the last century. The second section of the work is a study of university preaching, its methods of organization and use of rhetoric, with particular attention to the sermons of the 1230-31 period. Here the author provides Spanish translations of important passages from Hugh of St. Victor's *Didascalicon*, Alain de Lille's *Summa de arte praedicatoria*, and Thomas Chobham's *Summa de arte praedicatoria*. The last part of Fraboschi's work contains translations of five university sermons from the 1230-31 period placed facing the Latin versions previously published in M. M. Davy's *Les sermons universitaires parisiens de 1230-1231* (Paris, 1931). The sermons she has chosen to include are by William of Auvergne (in his capacity as bishop of Paris), Philip the Chancellor, Gerard of Laon, John of St. Giles, and a Franciscan friar.

While there is not much new here for scholars specializing on the University of Paris in the thirteenth century, Fraboschi's book does provide a good introduction for Spanish readers of the history and documents of the early university. Her work also focuses attention on an important but insufficiently studied genre of university writing: sermon literature. In the last decade there has been renewed scholarly interest in the structure and textual transmission of medieval sermons, particularly those of the thirteenth century. It is in this area, alongside the contributions of L. J. Bataillon, Nicole Bériou, Jacqueline Hamesse, and others, that Fraboschi's work will make a contribution and help bring those sources to a wider audience.

Madison, WI WILLIAM J. COURTENAY

Mise en page et mise en texte du livre manuscrit, sous la direction de Henri-Jean Martin et Jean Vezin, Paris (Editions du Cercle de la Librairie—Promodis) 1990, 472 pp., 445 illustrations, dont 64 de couleur, ISBN 2-7654-0446-1.

Ce livre, certainement l'un des plus beaux parus ces dernières années, confirme s'il en est besoin le rayonnement des études médiévales en France. Pour rester dans le seul domaine de l'histoire intellectuelle on peut citer *Le livre au moyen âge*, paru aux presses du CNRS en 1988 à l'occasion du cinquantenaire de l'Institut de Recherche et d'Histoire des Textes et *Histoire des bibliothèques françaises*, dont le premier volume concerne *Les Bibliothèques médiévales du VI^e siècle à 1530* et qui a été publié en 1989 par la même maison d'édition que le livre dons nous rendons compte ici. Ces trois publications de luxe ne constituent pas du tout une simple entreprise de vulgarisation destinée à «vendre» le moyen âge. Au contraire, il s'agit dans chacun des trois cas d'un volume collectif très sérieux, composé par une équipe d'excellents spécialistes qui ont

soit fait le point sur les résultats de recherches récentes, soit même effectué des recherches nouvelles. Mais on a pris le parti de faire rivaliser la qualité du travail scientifique avec celle d'une édition très soignée et mise en valeur par sa qualité esthétique. A partir de l'étranger on peut regarder ce phénomène avec une certaine envie pour la double richesse française: celle d'un public d'amateurs éclairés prêts à payer le prix fort pour profiter de la connaissance et de la beauté réunies en de superbes ouvrages, celle aussi du milieu professionnel qui les produit. Ainsi, parmi les 19 auteurs du dernier volume on ne compte que trois Américains, les autres étant des spécialistes français. Et parmi ces 16 Français, il n'y en a que deux qui ont également contribué au volume cité plus haut sur le livre au moyen âge. Décidément, Paris est l'un des centres de recherche les plus importants et les plus productifs en ce domaine.

Pour en venir au livre sur la mise en page et la mise en texte du livre manuscrit, il va de soi que dans une revue comme Vivarium, on cherchera davantage à être renseigné sur son intérêt pour l'histoire intellectuelle que sur les aspects codicologiques. Cet intérêt est du reste évident. L'activité de lire et celle d'écrire sont deux pratiques fondamentales de toute activité intellectuelle, qui n'étaient pas, avant les XII^e - XIII^e siècles aussi naturellement liées que nous les concevons aujourd'hui. Comme l'a expliqué A. Petrucci dans son article *Lire au Moyen Age*[1], l'écriture n'était pas, dans le haut moyen âge, au service de la lecture, mais poursuivait un but principalement esthétique, pratiquée comme elle l'était par des scribes professionnels peu habitués à la lecture. Ce clivage se traduit notamment par l'écriture continue et l'absence de toutes sortes d'aides à la lecture que peut fournir précisément la mise en page et qui apparaissent, de plus en plus fréquentes, au cours des XII^e et XIII^e siècles: écriture sur deux colonnes, articulation du texte soulignée par des rubriques, des marques de paragraphes, des initiales de taille différente, des titres courants, etc. Un peu plus tard encore on voit naître d'autres types de livres, écrits par les lecteurs eux-mêmes en langue vulgaire ou produits par des ateliers pour la cour, avant de retourner pour ainsi dire à une écriture quasi classique aux pages aérées et harmonieuses.

Paul Saenger qui à signé deux articles dans le volume qui nous intéresse ici, revient sur «La naissance de la coupure et de la séparation des mots» (pp. 446-449) et «Coupure et séparation des mots sur le Continent au Moyen Age» (pp. 450-455)—sujets auxquels il avait déjà consacré plusieurs études[2]—malheureusement sans répondre explicitement aux critiques formulées par Petrucci dans l'article cité plus haut (p. 606). Je me permets de poser à mon tour quelques points d'interrogation, sur d'autres aspects de l'argumentation de Saenger. L'observation que l'introduction de textes nouveaux et à caractère scientifique ait contribué à faire adopter la pratique de la séparation des mots me paraît tout à fait vraisemblable, mais pourquoi l'écriture à mots séparés telle qu'elle émerge à Fleury vers la fin du X^e siècle ne serait-elle pas comparable à celle des colonies irlandaises et anglo-saxonnes des VIII^e et IX^e siècles?[3] La différence de type d'écriture, minuscule caroline d'une part, lettres de forme insulaire de l'autre, ne semble pas constituer un obstacle à la comparaison. Et les raisons pour lesquelles ce phénomène s'est produit dans les deux cas, connaissance limitée du latin d'un côté, difficulté à comprendre des textes compliqués de l'autre, ne semblent pas trop éloignées non plus. S'il n'y a pas d'emprunt direct, il y a au moins un parallélisme certain. On peut se demander également si le terme *signa*, par lequel les modistes désignaient les mots, renvoie à la nouvelle valeur graphique (p. 455). Cet emploi se rapporte à une toute autre discussion, qui n'a, à mon avis, rien à voir avec le mode d'écriture.

Si j'ai abordé ce livre à peu près par la fin, ce n'est pas parce que je veux émettre des réserves sur la façon dont il est composé ni parce que le début serait moins intéressant. Procédant, après une belle introduction de la main de Jacques Monfrin, du livre antique jusqu'au livre imprimé, par chapitres thématiques (dont un sur la Bible, un autre sur les livres d'études, etc.), on fait justement dans la première moitié des découvertes passionnantes sur la façon dont on procédait dans des civilisations différentes pour coucher un texte sur papier et créer ce que nous appelons d'un terme très général un livre. Ainsi, le premier chapitre, sur le livre antique dans le bassin méditerranéen, comprend quatre articles: de Pascal Vernus sur les manuscrits de l'Egypte ancienne (pp. 16-23), de Colette Sirat sur le livre hébreu en Palestine (pp. 24-29), de Jean Irigoin sur quatre exemples de la littérature grecque (pp. 30-43), et de Robert Marichal sur le passage du *volumen* au *codex* (pp. 44-54). Ce voisinage permet de constater de ses propres yeux les ressemblances entre les rouleaux de Qumran et par exemple celui qui contient *Les Syconiens* de Ménandre: il s'agit d'une mise en colonnes, dont la hauteur est déterminée par la dimension verticale de la feuille qu'on déroule, la largeur par des impératifs physiques—les mains qui doivent déplier le rouleau, les yeux qui doivent parcourir les lignes—, tandis que le texte est aligné du côté où commence l'écriture (à droite dans le premier cas, à gauche dans le second), mais pas de l'autre côté.

Le codex représente évidemment un changement décisif dans la mise en texte. Le principe n'en changera plus jusqu'à nos jours, quelle que soit la matière dont il était composé et quelles que soient les différences, multiples et significatives, dans la façon dont on a occupé l'espace offert par ce support. Le livre en question est naturellement consacré à ces différences, sujet merveilleux, car de même que il n'y a pas deux êtres humains entièrement semblables, il n'y a pas deux livres manuscrits identiques. C'est une évidence, mais qu l'on a envie de souligner après avoit parcouru cette publication à la fois somptueuse et claire.

Dans l'ensemble on peut dire, à mon sens, que c'est autant l'utilisation du livre, l'objectif auquel il devait répondre, que des critères artistiques qui ont déterminé la disposition du texte. Passant sur les chapitres consacrés à la Bible, à la liturgie, à la patristique et aux textes classiques, je veux citer en exemple les manuscrits contenant la littérature latine de distraction, présentés par Pascale Bourgain (pp. 161-172), et les livres d'études. Dans le premier cas, il a fallu inventer une mise en page, d'ailleurs assez simple surtout au début de l'existence de ce nouveau genre littéraire, mais originale et enjouée pour la poésie lyrique. Les livres d'études, conçus pour le travail intellectuel, subissent le poids des commentaires qui envahissent la page sous forme de gloses à différents niveaux: la Bible d'un maître dominicain de Paris (présenté par Guy Lobrichon, pp. 181-183) montre comment le texte originel s'écroule sous les gloses interlinéaires, la *Glossa ordinaria* et le commentaire ultérieur, tandis que le Talmud présente un système comparable (Colette Sirat, «Le premier Talmud complet», 185-187), ainsi que par exemple des manuscrits contenant les *Décrétales* (Jacqueline Rambaud, pp. 204-209).

En ce qui concerne les manuscrits universitaires (Robert Marichal, pp. 211-217), la publication la plus récente sur la *pecia*[4] n'a pas encore été prise en compte. On y trouvera des précisions sur l'origine de ce système[5] et aussi des exemples de l'influence qu'il a eue sur la mise en texte. Sur la division du texte dans ce genre de manuscrits, structurés en livres, chapitres, paragraphes, questions et autres subdivisions, ce qui les rend plus facilement consultables malgré l'impression compacte de leurs pages très remplies, il y a désormais l'article très intéressant de Nigel Palmer[6], qui touche également à la disposition matérielle du texte.

Le dernier article du chapitre sur les livres d'étude est consacré aux «Concordances et index» (pp. 219-228). Richard et Mary Rouse y reviennent sur un sujet qu'ils connaissent bien et qui présente évidemment un intérêt particulier pour la mise en page puisqu'il s'agit d'instruments nouveaux pour lesquels il a donc fallu créer des formes nouvelles. Et d'ailleurs l'invention de l'index modifia la conception de la mise en texte elle-même à partir de la fin du XIII^e siècle. Dorénavant, un livre important est pourvu non seulement d'une table des matières, de titres-courants, de rubriques, etc., mais également d'une table alphabétique qui permet une utilisation rapide et ponctuelle.

Suivent deux grands chapitres dûs chacun à un seul auteur: «Traductions et littérature en langue vulgaire» (Geneviève Hasenohr, pp. 229-352) et «Illustration et mise en page» (Hélène Toubert, pp. 353-420)[7]. Ce sont des études très riches et fouillées, où l'on voit apparaître une nouvelle conception esthétique à l'époque où l'on approche de l'imprimerie. Après un chapitre sur «Le manuscrit et l'imprimé», on arrive au dernier, traitant de la façon dont on a aidé le lecteur, notamment par la ponctuation (Jean Vezin, pp. 439-445) et par la séparation des mots (voir plus haut). On y trouve aussi quelques beaux exemples de poèmes figurés (Jean Vezin, pp. 436-438) et de livres de forme insolite (même auteur, pp. 457), qui nous font comprendre la mesure de l'originalité des livres manuscrits, de même que le plaisir calligraphique qu'ils ont dû quelquefois procurer à leurs producteurs, comme d'ailleurs dans le cas du «plus beau manuscrit hébreu écrit en France» (Colette Sirat, pp. 100-104)où l'écriture devient dessin.

Voilà donc un livre d'une richesse extraordinaire. Bien sûr, on pourrait le rêver plus complet encore. Pour ma part, j'aurais été comblée par une étude sur la mise en texte des glossaires et dictionnaires, instruments pour ainsi dire vivants, en transformation constante. Mais n'insistons pas sur ce qui aurait pu être ajouté. Déjà tel qu'il est, le volume pèse lourd: en poids matériel, en science, en savoir-faire éditorial et en prestige.

'S-Gravenhage — OLGA WEYERS

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[1] Dans *Mélanges de l'Ecole Française de Rome, Moyen Age—Temps Modernes* 96 (1984) pp. 603-616.

[2] *Silent Reading: its impact on late medieval Script and Society*, dans *Viator* 13 (1982) pp. 367-414; *Manières de lire medievales*, dans *Histoire de l'édition française*, I. *Le livre conquérant. Du Moyen Age au milieu du XVII^e siècle*, Paris, 1982, pp. 131-141.

[3] Cf. p. 452.

[4] *La production du livre universitaire au Moyen Age: Exemplar et Pecia*, éd. L.J. BATAILLON, B.G. GUYOT, R.H. ROUSE, Paris (CNRS) 1988.

[5] Il était en usage à Bologne avant d'avoir été adopté à Paris. Pour l'apparente référence à la réglementation universitaire dans le contrat de Verceil, je renvoie à mon compte rendu dans la *Revue des sciences philosophiques et théologiques* 73 (1989) p. 571.

[6] N.F. PALMER, *Kapitel und Buch. Zu den Gliederungsprinzipien mittelalterlicher Bücher*, in *Frühmittelalterliche Studien* 23 (1989) pp. 43sqq.

[7] Il faut rapprocher de ce dernier les articles consacrés aux sciences exactes où les images explicatives déterminent également la mise en page (Colette SIRAT, *Euclide*, pp. 189-191: Emmanuel POULLE, *Astronomie et géométrie*, pp. 192-199).

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Announcement

Institut de Recherche et d'Histoire des Textes (Paris)
Constantijn Huygens Instituut (La Haye)

Programme de recherche:

La faculté des arts dans les universités médiévales: Paris et Oxford

Bien que les universités médiévales fassent l'objet de nombreuses recherches récentes ou en cours, la faculté des arts a été négligée par rapport aux autres facultés, dont celles de théologie et de droit notamment sont aujourd'hui beaucoup mieux connues.

Pourtant la faculté des arts, avec la richesse des disciplines qui y étaient enseignées, constitue un élément essentiel pour la compréhension de la vie intellectuelle du moyen âge et permet d'ailleurs, par l'évolution rapide des sciences et celle, non moins spectaculaire, de la dialectique et des réflexions sur la langue, de mieux comprendre certains développements de la culture scientifique moderne.

C'est pourquoi nous présentons un programme de recherche en deux volets: d'une part, il s'agit de préparer un fondement plus sûr pour les recherches ultérieures grâce à des travaux collectifs de longue haleine, d'autre part certains thèmes importants méritent d'être étudiés dès à présent.

I. Travaux collectifs

1. Il est indispensable de faire une révision du répertoire des maîtres ès arts parisiens de Glorieux (publié en 1971 et beaucoup moins sûr que le répertoire des maîtres en théologie du même auteur).
2. Parmi la masse des textes émanant de la faculté des arts qui restent inédits, il faudra choisir les plus importants pour en donner des éditions fiables et pourvues de commentaires.
3. Une étude d'ensemble sur le milieu intellectuel de la faculté des arts et les rapports entre les universités de Paris et d'Oxford pourrait être entreprise simultanément.

Il va de soi que pour ces travaux le répertoire des auteurs et textes anonymes et le répertoire des incipits des textes latins, présents à l'IRHT, seront indispensables.

II. Etudes thématiques

1. Les méthodes d'enseignement, les programmes et les examens à la faculté des arts. Cette recherche devrait notamment comprendre une comparaison entre programmes d'enseignement (tels qu'on les trouve dans les statuts) et règles d'examen d'une part, la production des textes émanant de la faculté de l'autre.
2. Le contenu et la place respective des disciplines; le statut et l'évolution des sciences exactes. Il s'agit de définir ce qui était réellement enseigné, les changements provoqués par exemple par la découverte de nouveaux textes, l'importance relative des disciplines dans le curriculum, les modifications dans le contenu et l'impact des sciences.
3. Les théories linguistiques de la faculté des arts. Il sera nécessaire de chercher dans

différentes disciplines, dialectique, grammaire, rhétorique, les indices d'un changement profond dans le concept même de la langue et l'analyse de son fonctionnement et de sa structure.

Pour réaliser ce programme, nous avons constitué un groupe de travail qui comprend actuellement de la part de l'IRHT les personnes suivantes: Jean-François Genest (philosophie); Marie-Henriette Jullien de Pommerol (histoire des universités); Claire Maître (musicologie); de la part de l'Académie Royale des sciences des Pays-Bas (Constantijn Huygens Instituut): Olga Weijers (histoire intellectuelle). Nous nous proposons d'associer d'autres chercheurs à ce programme et de constituer ainsi un réseau international.

Nous enverrons une lettre d'information aux participants et aux personnes intéressées pour les tenir au courant des travaux entrepris et des progrès.

Les résultats des recherches seront publiés en partie sous forme d'articles dans différentes revues; pour la publication des monographies et des ouvrages collectifs nous envisageons de créer une collection, si possible en coédition avec les presses du CNRS et celles de l'Académie néerlandaise des sciences.

Nous demandons aux chercheurs travaillant sur le même terrain de prendre contact avec nous en vue d'éventuels échanges ou autres formes de coopération.

IRHT (*Paris*) CHI (*La Haye*)